# The Institutionalisation of GMOs:

# Institutional Dynamics in the GM regulatory debate in the UK, 1986-1993

**Submitted by Mario Moroso, to the University of Exeter as a thesis for the degree of Doctor of Philosophy in Genomics in Society, November 2008.**



I certify that all material in this thesis which is not my own work has been identified and that no material has previously been submitted and approved for the award of a degree by this or any other University.

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# Abstract

This thesis analyses the process of institutionalisation of the concept of genetically modified organism (GMO) in the UK between 1986-1993. The existing accounts of the GM debate have focussed on either the 1970s or the 1990s. Very little, however, has been said about the 1980s, long before that of GMOs became a popular issue. Through a detailed examination of the PROSAMO initiative – a series of experiments aimed at determining the environmental impact of GMOs with a regulatory purpose in mind – this thesis have been able to explore the important but rather neglected role of the UK dominant institutions in the historical development of the debate over the release of GMOs into the environment.

In analysing the way 'GMO' institutionalised between the late 1980s and early 1990s, this thesis shows that the concepts of risk and uncertainty – which have dominated the GM debate – need to be conceived as collective constructs that are used strategically in order to pursue various objectives related to the context in which people using them operate. It is also argued that the legitimate use of these concepts is bound to the credibility and the authority of science.

These considerations have stimulated some reflections on the nature and role of regulation in the GM debate. In particular, it is argued that the move from a voluntary system of controls to a statutory one represents a move from an epistemic community approach to policy-making to a logic of bureaucratic politics, in which the literal interpretation of rules became a solution to political disagreement. As rule following became a political requirement, GMOs became a bureaucratic issue and scientists turned into bureaucrats. Within these changes, the role of scientific expertise in the definition of GMOs decreased. From this point of view, the way 'genetic modification' and GMO institutionalised gave rise to new practices and behaviours that turned around GMO as a controversial but nevertheless stable category.

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# Acknowledgements

Special thanks are due to Barry Barnes, whose thoughtful supervision and constant support helped to turn my early and often immature observations and ideas into something coherent and worth writing. For his support in my empirical work, I am indebted to Steve Hughes. Among those who were willing to discuss my work, all of whom deserve my gratitude, I would like to thank in particular Steven Hilgartner, Massimiano Bucchi and Federico Neresini. Significant parts of this thesis have been stimulated but their hints and observations. For their support with the English language, a special thank goes to my good friends Jonathan Davies and Seth Napier. A special thank to all the colleagues and friends at the University of Exeter who contributed to make these last four years very pleasant.

I am grateful to my parents, Annita and Giovanni, who too many times had to act as lay reviewers. Finally, and most importantly, I would like to thank my wife Elisabetta, without whom I would have never felt at home, and my son Giovanni, who constantly reminds me how great it is to learn new things.

# Introduction

This work has its roots in a previous research project I have undertaken as an undergraduate student of a five-year programme in Communication and Media studies at the University of Bologna, Italy (Moroso, 2003). It was a six-month project that was aimed at exploring the issue of the communication of science. I was very intrigued by the topic because as a former student of a scientific high school, I liked the idea of dealing with science again, even if only from a social sciences perspective. It was on this basis that I chose to study the reporting by Italian newpapers of genetically modified organisms (GMOs). Given the short life of the project, I did not have time for an extensive search of resources. I thus opted for a qualitative, semiotic analysis of a limited selection of articles related to a particular controversial issue involving GMOs. I executed a detailed semiotic analysis of a few articles on genetic modification that appeared on one of the two most read Italian national newspapers, *La Repubblica*, both before and after the German magazine *Frankfurter Allgemeine* published a story revealing that the pasta we normally eat is produced using wheat that has been genetically modified through irradiation.

It is easy to imagine the kind of reaction this story caused in both the supporters and opponents of genetic modification. The supporters took the opportunity to reaffirm their view that genetic engineering is just another one among many techniques available used to modify the genome of plants and animals. These techniques have been used for ages. The fact that we have been eating 'irradiated' pasta for the last few decades is a confirmation that GMOs are safe.

The interesting part was however the responses of the environmental groups and of the organic farmers association. Before the story became known in the public domain, their arguments put forward a vision of nature as a benign mother that provides everything human beings need to survive. In this light, human action of any kind was to be banned if it interfered with basic natural processes. At stake was our source of sustenance. Interestingly, this value system changed significantly after the Italian newspapers reported the story published by the German magazine. Nature was still a source of life and sustenance, but human interference was now acceptable. Their argument was that irradiation is different from genetic engineering because through irradiation the natural process of evolution that would occur anyway in a few thousands years because of cosmic radiation are simply accelerated. While writing my undergraduate thesis, I interpreted this response as a sign of the poverty of scientific arguments in public arenas. Science communication at a popular level was not primarily concerned with science, but with the demonisation of adversaries in a political struggle in an effort to delegitimise them.

Despite this conclusion being interesting in its own right, I do not think now it was the most interesting thing I could have said on the issue. With time, I came to the view that there was something more important going on at a more basic level that had much more sociological significance. I could have emphasised the fact that the value systems people invoke as motivations for their actions are flexible entities that keep being re-adjusted to different situations. The vision of nature proposed by environmentalists changed once it became widely known that the pasta we normally eat is genetically modified because wheat has been irradiated. I did not recognised the sociological significance of this change for a while, and only later I realised that values and beliefs are not good indicators for making sense of human actions. They are instead used by individuals to justify what they do, but do not determine their behaviour. When I realised this, I started to associate what I had learned from this sample of the Italian GM debate to what Durkheim (1982) argued about the inevitability of crime. People's definitions of criminal behaviour is never stable, and punishment is a ritual that helps the members of a community to re-affirm and reconstitute a sense of solidarity by marking as criminal the behaviour of those people or groups that in a particular historical moment are at the periphery of mainstream society. By identifying and punishing criminal behaviour people are able to recognise themselves in a general notion of proper behaviour. From this point of view, what people think about proper and criminal behaviour does not depend on any inherent characteristic of the actions undertaken, but is instead a reflection of the structure of society.

This sociological awareness anticipated what I would later find more finely stated by other scholars like Douglas (1986), Douglas and Wildavsky (1982) and Barnes (1974, 1977): that people's beliefs about nature are instrumental for the pursuit of certain interests, which depend on their position within a structure of social relationships. This is the idea that drove me to place my interest in communication to the margins of my current work. Rather, I have decided to trace the system of institutional social interactions that occurred at the earliest stages of the UK debate on the release of GMOs into the environment, between 1986 and 1993.This is an area that has been rather neglected in the most recent approaches to the study the GM debate from social and natural scientists alike. The core questions that this thesis will address therefore are: what was the contribution of the dominant institutions to the development of the GM debate in the UK? How is their contribution related to the rise of a negative public attitude towards GMOs? As one should expect, the attempt to answer these questions gave rise to a myriad of other related questions that will be progressively unveiled in subsequent chapters. The answers have been sought through a detailed study of the PROSAMO programme, which was a series of experiments jointly funded by the UK government through the Department of Trade and Industry and by some big multinational companies involved in biotechnology. PROSAMO was aimed at determining the environmental impact of releasing GMOs and was originally conceived in 1986, although the experiments were actually undertaken between 1989 and 1992. PROSAMO is the ideal starting point as it was the first attempt, by different institutional actors, to deal with GMOs with a regulatory purpose in mind.

In the light of these concerns, the first chapter will provide an historical resume of the GM debate from the mid 1970s to the beginning of the 1990s. This will offer a good foundation to deal with themost interesting period, 1986-1993, on which I mainly focus. 1986 is indeed the year when the release of GMOs into the environment really starts to become a major controversial issue at an international level. In line with many other developed countries, in the UK many start to feel the urge to do something about it, although this urge is not homogeneously distributed. This chapter will make apparent the importance of looking at the contribution of dominant institutions to the wider UK debate on the release of GMOs, an aspect of the debate that is underemphasised by the current approaches aimed at making sense of the widespread negative public response towards the new technology.

The second chapter will review these different approaches. I will justify the angle adopted in this work from both a theoretical and empirical point of view. The third chapter will describe the instruments used to explore the institutional dynamics. In other words, I will discuss the choice of the research methods, as well as their limits and advantages. Together, the first three chapters set the scene for the study of PROSAMO and for the analysis of its implications.

Chapter 4 will enter into the core of the discussion. I will explain in some detail the reasons behind the conception of PROSAMO by some industrial members and what they were trying to achieve by getting it started. Chapter 5 will expand the description of PROSAMO to include the motivations behind the involvement of the government in this initiative and the relationship established between academics and the other participants.

Chapters 6 and 7 will discuss major changes that occurred as PROSAMO drew towards a conclusion. In particular, it will be shown how both European wide and, mainly, national political dynamics had an important impact on the role of scientific expertise in defining the GM issue.

Chapter 8 will try to draw a connection between the study of PROSAMO, the institutional dynamics it made apparent and the wider debate on the perception of risk with regard to GMOs. It will be shown that a reduced role for scientific expertise in the definition of the GM issue gave rise to significant changes in the communication of GMOs as a scientific topic. I will then advance the hypothesis that these communicative changes may have played an important role in the emergence of a widespread negative attitude towards GMOs.

Chapter 9, the conclusion, will provide a summary of the thesis, will discuss the strengths and weaknesses of this study, will envisage new directions for further research, and will provide some advice for policymakers.

# Chapter 1 – The UK Debate on Genetic Engineering in the 1980s and the Release Issue

The public reaction to GMOs has been analysed from many perspectives by a multiplicity of institutions: from the European Union to single governments, from multinational corporations to academia. The focus of these analyses has inevitably been the striking, often highly visible public opposition towards the introduction of GMOs, particularly in the food production chain, in most European countries. Research in this area has often taken different directions leading to significantly different explanations of this social phenomenon. Despite their differences, all these explanations tend to focus on the GM issue as a problematic one only after it exited the institutional domain to enter the public discourse. Because of this, the primary concern has been the identification of the characteristics of the public that made it oppose the introduction of GMOs rather than the way the GM concept has been used by different social agents and thereby became institutionalised. This thesis, instead, will explore the institutionalisation of the GM concept with a particular focus on the UK context between the late 1980s and the early 1990s. Its starting point is an analysis of the GM concept itself and of the way it developed in the UK (section 1.1). This will emphasise an aspect of the controversy that tends to be overlooked by existing accounts – that is, the role played by the dominant institutions in the UK debate. The importance of focussing on the contribution of dominant institutions will emerge clearly in this chapter – which introduces the history of the debate (sections 1.2, 1.3 and 1.4) – as well as in chapters 2 and 3, which deal, respectively, with the themes and frames characterising the existing UK debate and with the methods used in this work to make sense of institutional dynamics. Together, these first three chapters set the stage for the study of PROSAMO.

## *1.1 What's in a Name?*

According to Levidow (1994), the naming of GMOs underwent a significant change over time.

> Until 1989, official documents and regulatory bodies in Britain generally referred to genetic 'manipulation', sometimes used interchangeably with 'engineering'. Given the sinister nuance of these terms, they were replaced by 'modification, which presents GMOs as a modest evolutionary step. The official term changed when draft legislation was published by European Community and then Britain. This terminological shift can be understood partly as a response to public fears – about novel organisms degrading the environment or about industry controlling human destiny. The shift formed part of an attempt to overcome doubts over whether the effects of GMO releases would be adequately controlled – that is, reliably predictable and socially beneficial. (p. 40)

The next chapters will confirm that public perception was an important issue for some companies and for some government officials, and that the stigma attached to GMOs could have been problematic from a commercial point of view. However, Levidow's description could have been more accurate. What one actually witnesses if looking at the prehistory of the GMO acronym, is a transition from "recombinant DNA research" frequently used in the 1970s, to the dominant use of "genetically engineered organisms" and "genetic engineering" during the 1980s – only rarely replaced by "genetically manipulated organisms" and "genetic manipulation" – to arrive to the final formula of "genetic modification" only after the mid 1990s.

More precisely, a quick search in the Nexis database will show that in the '70s the wording 'genetic modification' appears only in one article among all UK publications, insignificant if compared to genetic engineering (73 articles), genetic manipulation (8) or recombinant DNA (11)[1]. Although genetic engineering is clearly the dominant expression, at these frequencies of appearance this is not very meaningful. Actually, a reading of these articles reveals that 'genetic engineering' tends to be used as an umbrella to cover

[1] The search combinations were the following: "genetic modification" or "genetically modified organisms" or "GMO"; "genetic engineering" or "genetically engineered organisms"; "genetic manipulation" or "genetically manipulated organisms"; "recombinant DNA" or "rDNA". Searching periods begin and end with September 16th. For example, I searched the use of the terms "genetic engineering" between September 16th 1972 and September 16th 1980.

various techniques for modifying the genome, including recombinant DNA technique. The 'genetic engineering' formula as a synonym for recombinant DNA has become frequent in the popular domain only since the 1980s, and particularly after 1985. In the decade 1980-1990, the wording 'genetic engineering' in UK publications appears in 1306 documents, and is followed by 'genetic manipulation' (143), 'genetic modification' (107) and 'recombinant DNA' (55).

Since 1990 the situation starts to change and between 1990 and 1995, 'modification' appeared in 669 UK publications, six times more than in the previous decade. The 'engineering' formula increases too, but at a much lower rate, from 1306 (1980-1990) to 3160 (1990-1995). Still, genetic engineering in the first five years of the 1990s is the dominant form, and it will remain so until 1998, when 'modification' is used in 8568 publications against the 6994 uses of 'engineering'. This runs against what Levidow claimed – that 'modification' takes, in the early 1990s, the place of both engineering and manipulation as the result of a public relations exercise by both the companies and the government involved in biotechnology policy. It is true that it is possible to identify a trend in those early years, but engineering still plays a fundamental part in the debate[2].

A semantic consideration of the different labels that are used to cover organisms modified through the use of recombinant DNA technology, shows that these terminological changes cannot simply be attributed to an awareness of the commercially detrimental effects of a negative public perception of the new technology and products. The key terms that Levidow identifies – engineering, manipulation and modification – deserve more attention. They all point to the emergence of something new and different from what had previously existed, but they do so in significantly different ways.

Let us consider the term "engineering" first. Engineers tend to concern themselves with the scientific analysis of problems, the search of solutions and

[2] It is true that Levidow talks specifically about official documents and regulatory bodies, but it is also the case that if we look at the industry trade press, which should have surely been interested in using the GMO formula, we can see that GMO has been used 415 times between 1990 and 1995 against 1415 for 'genetic engineering'.

the organisation of resources. It is therefore frequently associated with an attempt to improve an existing situation that is perceived to be problematic by someone. Thus, the approach of the engineer can be considered as purposeful action, which is associated with a professional, scientific, character.

"Manipulation" also refers to something new as compared to a previous state of the world. As with "engineering", it implies the modification of the state of the world with a purpose in mind. But in contrast to engineering, manipulation does not seem to require the identification of a problem. One can manipulate a piece of wood and turn it into a statue because one thinks that this is fun. Secondly, the concept of manipulation does not imply any professional character. Both professionals and non professionals can engage in manipulating activity.

"Modification" is a further move towards impersonalisation. With modification, not only is any reference to a professional dimension missing, as in the case of "manipulation", but so is the idea of a purposeful action. It is however important to bear in mind that the concept of modification does not neglect purposeful or professional action, it just includes them in a wider range of possible changes. For example, modifications of the state of the world frequently occur spontaneously in nature. Human activity can be included within this natural framework.

It is also appropriate to stress that all these terms make reference to a process of change as well as to the product of that change. But it is interesting that the nature of the product is determined by the process with which it is produced. In other words, the terms or combination of terms just considered establish a new category of objects which possess a perceived and recognised distinctiveness from objects that already exist. The distinctiveness comes from the process that is used to make these products rather than from what the products actually do.

A few questions need to be made explicit at this point. What is the meaningof these terminological changes? Why does the professional character disappear from the label attached to these new objects? Why does reference to purposeful agency move to the background? What social dynamics do these terminological changes reflect? What expectations and concerns are behind agents' choice of a particular label? What expectations and concerns are behind the emphasis on the process? A closer look to the historical background will be helpful to answer these questions.

### *1.2 The regulation of GMOs in the UK in the 1970s*

The story of the regulation of genetic engineering in the 1970s and early 1980s plays an important role in this thesis. Indeed, it sets the stage for the emergence of the problem of the release of GMOs into the environment. Probably, the best source of information for this historical period is Susan Wright's book *Molecular Politics*[3]. In this book, Wright tries to uncover the history of the regulation of the use of GMOs in the laboratory both in the UK and US, showing how different social actors with different objectives interacted and negotiated with each other in order to come to an agreed legislation. In this section the focus will mainly be on the UK experience.

Wright describes how in 1972, when the first genetic engineering technique appeared, the world responded with a mixture of hope and fear. For universities and scientists, the new field of enquiry represented a new source of funding in a difficult economic global context and a new science and technology policy environment that was emphasising accountability and justification for continued support in terms of practical outcomes.

> Both sides of the dual support system were hurt by the cuts. Government support for research and development in British universities through the UGC's block grant grew by about 7 percent from 1971/72 to 1978/79, although it was estimated that the amount spent for research per staff member actually decreased by 28 percent in this period as a result of the expansion of the universities and the increasing seniority of their faculties. The Research Councils fared no better. Support for all of

[3] Other useful sources on the history of the debate on recombinant DNA technology in contained environment are Lear (1978) and particularly Krimsky (1982). For an account of the regulation of recombinant DNA research with specific focus on Britain see Bennet et al. (1986). The regulation of the release of modified organisms into the environment in Britain is given extensive treatment by Levidow (1994). For the viewpoint of a key participant in regulation see Beringer (1988, 1991).

> the councils fell by 11 percent in real terms between 1974/75 and 1978/79. This decrease in funding combined with the utilitarian emphasis of the Rothschild reforms of 1971 to shift the policies of the ABRC and of the individual councils away from a responsive mode of operation […] to an interventionist mode, in which scientific development was actively shaped by government priorities. (p.59-60)

In this context, it is not surprising that recombinant DNA technology could justify support for molecular biology, a field that until then had not yielded any practical results. For the UK government and its agencies, the new field represented an opportunity for both the country's wealth, in terms of fees and royalties, and its national scientific pre-eminence and prestige (which would also have had a commercial impact too).

Even though the research on genetic engineering was mainly undertaken within universities during the 1970s, industry was not indifferent and closely followed its development. This is because it simultaneously represented a promising technology for the creation of new products and a threat to established markets. However, industry's role became prominent only once prospects for industrial applications became apparent.

Despite the powerful expectations surrounding recombinant DNA technology, there were also some problematic issues related to the potential effects of the technology. Wright stresses that the new technology grew within a wider social debate over the control and direction of science and technology – a debate that began towards the end of the 1960s, under the influence of the antiwar movement and public concerns over consumer and environmental safety. It is not therefore surprising that the new potential unlashed by genetic engineering also became a reason for ethical and social preoccupations that were widespread within the scientific community itself. In the UK, the focus on research on viruses causing cancer increased the level of attention on safe laboratory practices. At stake was the safety of workers as well as the possibility that new organisms produced in laboratory could escape the laboratory and cause an epidemic – concerns that, Wright reports, received widespread attention when in 1973 a technician contracted smallpox and infected two others before being diagnosed. Worries about pathogenicity were coupled with concerns about control. How and by whom genetic would engineering be controlled?

Within such a context, scientists' attitude towards the new technology was inevitably ambivalent. Fears of misuse of the new technology and uncertainty about the potential hazards were always accompanied by concerns about restrictions to research in the new field. Scientists recognised the potential social, ethical and environmental problems related to the development of recombinant DNA technology, but at the same time feared that too much public resistance would have jeopardised an industrially promising, and therefore politically justifiable, enterprise. In Wright's account, this ambivalence was managed by the scientific community by maintaining control upon the definition of the issues at stake and by emphasising the benefits rather than the hazards when addressing the public. As she points out, scientists facing a novel form of technology turned to their own leading organisations for guidance in addressing the issues. This was the purpose of the famous Asilomar conference, in 1975, which was the culmination of a wide scientific debate on biohazards that had started in 1973 (see also Cantley, 1995)[4]. This debate was entirely internal to the scientific community, which allowed the problems to remain strictly technical and confined to the identification of laboratory hazards. In other words, by keeping the problem of genetic engineering at a technical level – by mainly talking to themselves – scientists were able to avoid the interference of a broader range of people who were likely to have brought different issues into the discussion.

In the UK, questions of the control of dangerous pathogens were addressed by the Godber committee under the Department of Health, in front of which some leading British scientists cautiously expressed worries about possible restrictions to research on genetic engineering, the need to make possible hazards known to the public and the need to make the potential benefits of the new technology clear. Despite the committee's willingness to look into the possible hazards of genetic engineering, British scientists were not particularly keen to have this new field associated with dangerous pathogens and the

[4] The Asilomar conference has been discussed also by Wade (1977)

Department of Health. According to Wright, potential users of the new technology preferred to see supervision for the new technology under the aegis of the Department of Education and Science and of the Research Councils. She suggests that it is in this light that one should understand the creation by the Advisory Board of Research Councils (ABRC) of the Ashby Committee and subsequently the creation of the Genetic Manipulation Advisory Group.

The Ashby committee was charged with making a technical assessment of the potential benefits and hazards of genetic engineering, without focussing on ethical questions. The committee received evidence from a group of British scientists who were involved in research projects in this new area, and who are likely to have expressed caution about the new technology but who were also interested in the research not being restricted. Many of them sought a system of voluntary control managed by the organisations in charge of funding research and which would be likely to support it[5]. On the basis of this evidence, the committee wrote a report in January 1975, the tone of which was a mixture of optimism and reassurance, emphasising the benefits for biomedical and industrial applications. In particular, the Ashby report emphasised the following:

1. The benefits of genetic engineering far outweighed the hazards.
2. The forms of control should be expressed as voluntary code of practice.
3. Because of these benefits, research in this area should continue after a voluntary code of practice has been established.

It is in this spirit that British scientists participated to the Asilomar conference in April 1975. The conference itself is described by Wright as a powerful policy instrument in the hand of the worldwide scientific community. First of all, the participants were carefully selected. For example, there were several participants from industry and no one from public interest organisations. Moreover, heavy restrictions to press coverage were placed. Given the composition of the participants and the form taken by the panels – it was mainly a technical exercise and the organisers gave little space to ethical issues – the outcome was quite predictable: the proposal of guidelines for genetic engineering and of the lifting of the moratorium that both the Berg

[5] Brenner, “Evidence for the Ashby Working Party”.

committee[6] in the US and the Ashby committee in the UK endorsed. Indeed there were very few participants interested in maintaining the suspension of research initially promoted by the Berg committee. Wright interprets the actions of the scientific community as a skilful manipulation of public opinion – since the result was a misleading image of a community willing and moving to restrict research on genetic engineering – and as a successful creation of a politically favourable environment in which a reductionist discourse strategy was functional to the exclusion of the social from the definition of the 'genetic engineering' problem and to the reinforcement of the central role of the biomedical research community in policymaking.

Asilomar also had an important impact in the UK and the Research Councils sponsored a conference in Oxford in which British scientists were able to discuss hazards of the new technology and to seek oversight on genetic engineering activities under the responsibility of the Department of the Education. The trade unions played an important role too, thanks to the room within the political arena granted by the Health and Safety at Work Act (1974). On the one hand, they were concerned about the health and safety measures protecting the employees in laboratories, but on the other hand they were very sensitive to competition issues and did not want British research to fall behind immediate competitors such as US and Japan.

Under the mounting pressure from different directions, the UK government set up the Williams committee, which was in charge of outlining a regulatory framework for the control of genetic engineering and in which the scientific community was very well represented. Wright is clear that the work of the committee was affected by the weight of the trade unions who were seeking a prominent role in policy making, by the responsibilities of the Health and Safety commission to apply the Health and Safety at Work Act, and by the Labour government's intention to consider seriously the Unions' proposals. The work of the Williams committee culminated in the establishment of a compulsory system of notification and consent – lobbied for by the trade unions – that was provided on a case by case basis. Laboratory safety measures were ranked in

[6] Scientists on both sides of the Atlantic were active players in safety discussions, even though in the US formal steps were taken by scientists a few months earlier than in the UK.

levels of containment dependent on the phylogenetic distance between humans and the source of DNA to be inserted. Surveillance was the responsibility of the Genetic Manipulation Advisory Group (GMAG), the advisory group established by the Department of Education and which held its first meeting in January 1977. Although the functions of GMAG were quite clear, it was less clear how and under whose aegis the advisory group would have had to operate. This was because genetic engineering touched the interests of different groups. For example, the Department of Education and Science or the Health and Safety Executive both had concerns in this area. The unions, having a strong representation in the Health and Safety Commission, wanted the GMAG under the aegis of the Health and Safety Executive, a solution that would not have been appreciated among many of the scientists. The final composition and remit of GMAG represent this struggle for power and control among different organisations and agencies.

The advisory committee went under the aegis of the Department of Education but the Health and Safety at Work Act constituted a strong framework for its decisions. Its composition reflected a variety of interests, with scientists, employers (industry and vice-chancellors), trade unionists and representatives of the "public interest" – who should have been educated enough to grasp the meaning of the issues at stake – brought together in the decision making process. Despite this diversity, the selection of the members of GMAG reflected the underlying widespread assumption that research on genetic engineering had to move on. The composition of GMAG was such that it was possible to identify cross-cutting interests that could ensure that a compromise could be found, despite the different views held by participants.

In essence, the laboratory hazards debate saw the formation in the UK (but also in the USA) of a single policy paradigm that "was supported by a discourse that recognised that the hazards of the field were still unknown but assumed that they could be contained through the use of physical and biological restrictions that did, however, allow for expansion and spread of the techniques" (p. 216). It is true that the impact of the unions widened thediscussion from a merely technical focus by making human behaviour a legitimate problem, therefore expanding the kind of expertise necessary to evaluate activities involving the use of recombinant DNA technology. But it is also true that the organisation of GMAG offered the scientific community more significant political power than that one offered to unions – who also would have had to respond to scientists themselves, had British biotechnology failed to maintain its competitive edge worldwide.

The power of this single policy paradigm is further exemplified by scientists' and industry's subsequent dissatisfaction with the Williams committee safety protocol[7]. The lack of a real consensus on the hazards of genetic engineering allowed many scientists together with the interested companies to argue against a system of control that had worked quite well during its first stages – given the low number of applications that had to be examined – but that had started to be perceived as oppressive once the number of applications reached a critical level that was difficult to manage. In addition, by 1977 it appeared clear that the US was relaxing its own system of controls in order to make it more flexible and faster. Under this pressure, the UK scientific community and industry pressed for a revision of the categorisation established with the Williams Committee. This revision took place with the implementation of a risk assessment scheme – the Brenner Scheme – introduced in March 1979, which changed the categorisation system by defining most of the genetic engineering experiments as Category I (the safest) work or as needing "good microbiological practice" (GMP). GMAG supervision on a case by case basis was therefore required for the minority of experiments falling under category II, III and IV (Cantley, 1995).

The Brenner scheme did not reduce the uncertainties about the hazards posed by genetic engineering, but apparently made them more manageable within an environment requiring protection. The original scheme "attempted to trace all the pathways by which this [foreign] DNA might be transferred, be expressed and produce some harmful effect, and then to calculate the probability of such a sequence" (p. 328), but as Wright shows (p. 328-329), Brenner himself was aware of the uncertainties involved in such prediction and of the need for more experimental data that could make accurate prediction possible. Despite its

[7] The pressure to accelerate the approval of applications is well expressed by Pritchard in *Nature*, 276:2-3

uncertainty, and probably stimulated by the relaxation of controls by the NIH in US, it was thought that “it could still be possible to calculate rough, order-of-magnitude values, which could yield a qualitative ranking of hazards” (p. 331), on the basis of “arbitrary assumptions” (p. 332) and “by arbitrarily imposing certain plausible constants” (p. 332). From these indications, it seems clear that despite the Brenner scheme having been labelled risk assessment scheme, there was very little interest in determining the hazards experimentally. This is in line with the implementation of the antecedent Williams recommendations, when GMAG group applied little efforts to solve the problem of assessing the hazards of genetic engineering. Wright argues that “experimental investigation of hazards was not a high priority” (p. 326) because it “conflicted with pursuing genetic engineering itself, which was generally seen as a much higher priority” (p. 326). Something similar happened under the Brenner Scheme. “The MRC and research scientists alike had no enthusiasm for pursuing an expensive and time-consuming program designed to measure the variable of the risk assessment scheme. The prospects for genetic engineering were too tantalizing, and no one particularly wanted to tie up Britain’s limited facilities with “unproductive” research” (p. 333).

The arbitrariness of the Brenner scheme categories played an important role in the subsequent regulatory debate. As Wright points out, “estimates of the probability of harm had to be matched with appropriate containment categories – an exercise that necessitated arbitrary assumptions” (p. 332). She then quotes an internal GMAG memorandum: “The analysis is flexible because it provides a scale of relative risks; and the index of risk does not itself determine the containment category, which can take policy into account as well as science”. For this reason, Wright argues, “GMAG could apply the scheme as cautiously or as freely as external (extrascientific) considerations permitted” (p. 332). In the 1980s, under the pressure from industry and many British scientists, the flexibility of the Brenner scheme allowed GMAG to progressively match the relaxation of containment requirements undertaken by NIH. This was facilitated by a number of factors, including the increased importance of industry as a social actor, the progressive weakening of the trade unions under the newly elected Conservative government, and the cool reception of the new risk assessment scheme elsewhere in Europe in favour of the NIH guidelines.

By 1982, the relaxation of safety requirements and the parallel relaxation of oversight were complete. Parity with the American system being achieved and a flexible system of controls established, British scientists felt no pressure to keep GMAG under the aegis of the Department of Education. In 1984 then, the Advisory Committee for Genetic Manipulation (ACGM) superseded GMAG, and its functions were transferred to the Health and Safety Executive, a move that was supported by industry and the trade unions. According to Wright, "there was a strong sense, in 1984, that the ACGM's most important roles would be cosmetic and reactive[8]: cosmetic in the sense that the committee would act, in the words of the chair, as "comforter" to those with anxieties about genetic engineering; reactive in the sense that the committee would act only when anything problematic emerged" (p. 436-437). Wright suggests that this limited role may be justified by the lack of support from the government and by the consequent lack of financial and human resources.

Wright's account of the debate is revealing as it gives an idea of how the different terms identifying the new technology really reflects an attempt to manage institutional relationships in a mutual beneficial way. During the 1970s, scientists managed to monopolise the debate by keeping it at a technical level and limited to the identification of laboratory hazards. The fear was that these concerns would have slowed down or even stopped research in this emerging field. It is now possible to see the use of the label"recombinant DNA technology" as a reflection of this monopoly. When scientists were talking to themselves or were asked an opinion about the hazards associated to the new technology, they preferred to talk about cancer-causing viruses that were a threat mainly to lab workers and to refer to the technology itself with the more scientific and value free 'recombinant DNA work' formula rather than 'genetic engineering' or 'genetic manipulation'. In fact, it is interesting to notice that in the Berg letter there is reference to neither 'genetic engineering' nor 'genetic manipulation' and much favour for formulas like "recombinant DNA molecules" or "artificial recombinant DNA molecules". Also the 1977 recommendations from the American Society of Microbiology (ASM) were using "recombinant DNA molecules" or "DNA recombinant activities" in order to refer to the work in

[8] On this, however, Wright acknowledges that regulatory procedures had some impact on safety (p. 524). See also Ravetz (1990:63-80).

what is today known as genetic modification technology. Even at the European level, where British scientists were very much involved, 'genetic engineering' is hardly used for quite a while. The DGXII biology staff formulated in 1978 a proposal for a council directive concerning safety measures in relation to "recombinant DNA work". In 1976, the ESF stated that "research on recombinant DNA molecules" should be promoted by European governments. Again, in a one page report in 1981. the ESF claimed that "recombinant DNA work" or "techniques" or "methods" or "research" did not entail any significant novel biohazard.

### *1.3 The release of GMOs in the UK*

The movement from 'genetic engineering' used as an umbrella term to cover various genetic modification techniques to being a synonym for recombinant DNA technique, since the early 1980s, overlaps with significant changes in the context of institutional relationships. Wright points our attention towards some of the new issues emerging. "The definition of *genetic manipulation* used by GMAG and the Health and Safety Executive covered the *construction* of new combinations of DNA but not explicitly their subsequent use" (p. 426). Towards the end of the 1970s and the beginning of the 1980s, the uses become very important.

The settlement of the regulatory debate around the contained use of genetically modified organisms by about 1982 coincided with the increasing role played by industry and the parallel emergence of new problematic issues such as the release of recombinant DNA-containing organisms into the environment or the large scale applications of rDNA technology, which were not covered by the existing regulation. According to Wright, until September 1982 "possible hazards involved in increasing their *scale* [of new processes] from laboratory cultures to the large volume characteristic of fermentation processes received scant attention" (p. 427). At this time, the third GMAG report reminded users of genetically manipulated organisms that GMAG considered it appropriate to extend its surveillance work to the use of a genetic manipulated organism even though this activity was not covered by the genetic manipulation regulations, especially considering HSE reluctance (probably because of its anticipated budget cuts) to take action. The unclear regulatory coverage of the use of genetically modified organisms did not change with the creation of ACGM.

ACGM however, under the aegis of the HSE, established a working group operating from the 1984 to the 1986 with the responsibility of looking at field releases of genetically modified organisms. It was the Advisory Committee on Genetic Manipulation – Deliberate Release Working Group. The working group was started on the initiative of the later chairman of ACRE (Advisory Committee on Releases into the Environment), John Beringer. He reconstructed the events in the following way:

> What actually happened was, in about 1983, I was on the Ministry of Agriculture committee and I wrote formally to the ministry and said "genetic engineering is happening. Very soon people will be wanting to release organisms. You should do something about it". And they didn't do anything about it at all[9]. (*Interview*)

And he continues:

> […] I was in ACGM which looks after laboratory experiments. And we decided within that committee that because Ministry of Agriculture and the Department of Environment were doing nothing "can we (inaudible) set up a group to look at the issues?" and that is how it started. (*Interview*)

The working group converted in 1986 into the Planned Release Sub-Committee (PRSC, which was soon renamed the Intentional Introduction Sub-Committee (IISC). As described by Levidow and Tait (1993) "the IISC followed the tripartite basis of all health and safety committees. Its 'specialist members' included a CBI nominee, a TUC nominee, and scientific experts drawn from academia and government-run research bodies" (p.196). The IISC was the precursor of ACRE,

[9] There is an interesting 1983 Communication of the European Commission to the Council (COM (83) 500) that explicitly refers to biotechnology as a way to improve land use, for example in forestry. The reference is only a short one, but it is clear that the Commission was referring to the possibility to modify trees for wood production or even to modify food and feed crops to increase production to have land available for other uses. It is thus understandable that the Ministry of Agriculture was not very interested about the hazards.

the new advisory committee created in 1990 from the merging of IISC and a temporary committee established by the Department of Environment (DoE) in 1989, IACI (Interim Advisory Committee on Introductions)[10].

Although IISC mainly comprised specialist scientists, Levidow and Tait claim that its task was more than technical. According to the two authors, expertise in IISC had the double function of being a regulatory instrument and of averting public unease outside the scientific community. John Beringer confirms this interpretation:

> That's why I initially wrote to the ministry of agriculture and said "do you want to do something about it, because here is a new technology and we well have to handle the implications"…we should remember Asilomar scientists said "this technology is potentially hazardous and therefore needs to be regulated…GM crops are safe to the public (…) go and eat it, have it in your back garden", which was the complete reverse of the Asilomar (inaudible). So right in the very beginning public perception has always been an issue. (*Interview*)

Thus, one of the possible uses of genetic engineering, as Beringer called it, was their release into the environment. But Beringer's words are more revealing than this. By comparing the Asilomar events with the creation of the new ACGM sub-committee, it confirms that regulation started because there were serious concerns about public perception and that these concerns were brought forward by a reputable scientist who was already deeply involved in regulatory work. It also suggests that there was something different in the approach to regulation within the scientific community. The difference is that concerns about the hazards of the release of GMOs into the environment were not very widespread. Regulation and safety were now for scientists only marginal aspects of their work in genetic engineering. The context in which discussions about the regulation of the release of GMOs into the environment were taking place is therefore very different from the one in which regulation of laboratory hazards were formed. As explained in the previous section, in the 1970s

[10] The DoE sought to use genetically modified organisms as a way to restore credibility and power in the management of the Environment. See for example DoE (1989, 1993a, 1993b), DoE/HSC (1991, 1992) and DoE/MAFF (1992).

scientists were genuinely worried about safety[11] but were also aware that global competition required constant progress in research activity. Scientists tried to address both issues with one move. By regulating themselves, they managed to both be and appear cautiousand to ease public concerns which risked slowing down research down to unacceptable levels. With the release of GMOs at the centre of the debate, there was no direct link between public perception and safety, so there was not explicit support for regulation from the wider scientific community.

Scientists were instead much more worried about the financial constraints that the UK government, under the leadership of Margaret Thatcher, was putting on them. As explained in more details in Chapter 5, emphasis on accountability and utilitarian concerns became even stronger than during the 1970s. Science needed to serve the economic development of the country, and in this context, industry became the main beneficiary of government action and acquired a more central role. Scientists found themselves moving in this multifaceted institutional context, with others' interests in need of satisfaction as well as theirs. The move towards 'genetic engineering' and 'manipulation' well reflects the end of scientists' monopoly over the definition of the issue.

Even before the emergence of the release problem, the scientific community was already starting to show signs of impatience towards the systems of regulation that they themselves had promoted. For example, the previous section well illustrated how scientists were dissatisfied with the Williams committee safety protocol and were pushing for a more flexible approach to the regulation and management of the contained use of GMOs. Also the European Science Foundation (ESF), in 1981, was pushing for a more relaxed attitude towards recombinant DNA research, which was not considered to pose any significant threat even beyond small scale laboratory work. Indeed, in the one-page report already mentioned in the previous section, it argued that "although some concern has been expressed about the biosafety of these large scale operations, the Liaison Committee points out that the fermentation industry already has long and extensive experience of large scale fermentation,

[11] That rise of safety as a major concern in the 70s is confirmed by Lear (1978:32-36, 54-59) and Krimsky (1982:39-69). See also Brill (1986) and Colwell, Elliot et al. (1985).

including that of known natural and dangerous pathogens. [...] The Committee emphasises that the large scale fermentation of micro-organisms produced by recombinant DNA molecules methods does not pose novel or special problems". The ESF then concludes that "there is no scientific justification whatsoever for new legislation specific for recombinant DNA research and moreover, it [the Committee] sees no justification for further extensive recombinant DNA risk assessment programmes" (source: Cantley, 1995). Thus, worries about public concerns among the regulators were not supported by a parallel genuine concern for safety. Beringer is quite clear about this:

> **Q:** I was wondering what the attitude of the scientific community was during the 80s, and in the middle of the 80s in this case, towards this kind of research, this new technology. I mean what was the general position as far as safety and risk were concerned?
> **A:** The biggest difficulty was actually trying to convince people that there was a need of formal management of it because most people were not concerned about dangers. Scientifically it is very hard at the moment to see were the hazards are of what has been produced and back on these days even more so.
> **Q:** When you say it was difficult to make people understand you refer to...
> **A:** Other scientists...even now most molecular biologists will tell you that a well manipulated plant is at least as safe as a naturally bred plant, so what is the fuss? And on those days, the concept of it being a fuss was (inaudible)...What has happened was anywhere anticipated.
> **Q:** So people were thinking...
> **A:** This is a useful technology; the benefits will clearly be seen to outweigh any possible disadvantages. [...] one could envisage ways in which it could be risky you know you put in rice genes and bacteria and cause real problems but you also knew that by controlling what you did you could reduce the risk down to a very very low level. So like any other technologies it can be risky or not. At the time I had a very interesting meeting with the US Department of Agriculture, early 90s. I said to them "I am worried about what's happening in Britain, a lot of negative opinion", and they told me I was just talking nonsense. "You know it is a

> good friend, you're off the ball, you lost it, it is not going to be a problem". And it is exactly the way in the mid 80s people were feeling. (*Interview*)

## *1.4 The European Context*

Beringer's answer reflects the judgement of large part of the scientific community at the European level, where there was widespread consensus about the safety of releasing GMOs into the environment. The first attempt to undertake a common European biotechnology strategy, with the Biomolecular Engineering Programme (BEP) between 1982 and 1986, resulted in the funding of 103 projects, of which only two explicitly addressed the risk issue (Cantley, 1995:518).

Important scientific organisations exercised some influence also at a regulatory level. Within the community the international situation with regard to the regulation of genetic engineering was closely monitored, particularly by the DG XII, the Directorate-General for Science, Research and Development, which already in 1978 formulated a proposal for a Council Directive that could deal with the conjectural hazards of recombinant DNA technology (C301/5-7). The directive would have required statutory notification and authorisation by national authorities for all activities involving recombinant DNA. However, the development of the legislation in USA and in the UK convinced the Commission to replace the proposed Directive with a proposal for a Council Recommendation inviting European Member States to "adopt laws, regulations and administrative provisions requiring notification – not authorisation – of recombinant DNA work" (p. 519). The decision of the Commission was partly influenced by the interventions of the ESF, as already seen, and the European Molecular Biology Organisation (EMBO). The ESF was created in 1974 and represented an agora for the research councils in Europe, so that it could be possible to promote common objectives and basic research in the continent. In line with what was going on in the UK, in the middle of the 1970s EMBO recommended promoting and developing research into the new technology in Europe while acknowledging the potential hazards and the need to protect the public and the environment. Furthermore, it auspicated the harmonisation of containment categories in Europe and a fluent circulation of information among the national supervisory bodies. EMBO's cautious position changed substantially in 1978, "endorsing the American proposal to shift the burden of proof to those who advocated special precautions" (Wright, p. 334) because the probability of hazardous events was deemed to be extremely low. Cantley (1995:527) also mentions the influence of the Scientific Committee on Genetic Experimentation (COGENE), within the International Council of Scientific Unions, in the development of a not too stringent European regulatory framework, by the late '70s and early '80s.

Despite these efforts by influential scientific organisations to lift restrictions on biotechnology research, there was the idea in the European policy arena that regulation was inevitable, although it had little to do with safety. Already in 1979, the Economic and Social Committee (ESC) – a consultative body involved in all legislation and representing the consumers, trade unions and business – expressed explicit support for the directive initially proposed by DG XII in 1978. This was not as much on the basis of scientific evidence of the need of safety measures, however, as for public relations reasons. In other words, ESC claimed "that legislation would help to reduce the latent mistrust among the general population" (p. 521). It also stressed that if legislation had to be adopted, this would have had to be flexible enough to adapt to a rapidly changing scientific field.

A sense that regulation was perceived to be not only inevitable, but a necessary step comes from other documents. In 1983, the European Commission presented a Communication to the Council titled *Biotechnology in Europe*. Its annex, COM (83) 672 final/2 ANNEX, expressed serious concerns about European competitiveness in biotechnology, a field that was considered of core importance given its potential impact on many industrial sectors. It is clearly stated that in this key scientific and technological field, the US were ahead of Europe both in terms of the number of patents and in terms of investment aimed at exploiting recombinant DNA technology. The European commission thus urged closing the gap with the US by the removal of the bottlenecks to European industrial development.

The Commission's communication is clear in identifying the cause of Europe's lack of competitiveness in the fragmentation characterising the research and regulatory efforts within the Member States. This fragmentation is not suitable for the expensive implementation of expensive biotechnology. "The requirements of modern biotechnology in skills, materials and information (even in the case of published data) are so large that new approaches have to be devised and implemented at Community scale" (p. 25). In other words, the requirements of biotechnology are beyond the capabilities of any Member state or European firm taken in isolation. To increase competitiveness, the Commission argues, it is necessary to create a "strong Community nucleus of expertise to serve as a driving force for a systematic and coordinated implementation of mission –oriented research in biotechnology" (p. 23). Besides the need for expertise[12], the Commission envisages "concertation of the various activities relevant to biotechnology" (p 53). Concertation should comprise "an expanded series of networks, established in cooperation with the Member States to provide an ad-hoc system of collaboration between individuals, specialised groups and institutions. This will be coupled with an information base, regularly updated by scanning, selecting, interpreting and storing in an organized way the incoming flow of information" (p. 54). In other words, the Commission should be able "to monitor and anticipates development in the situation, and concert necessary policy discussions and initiatives across the services, with Member States, and with other relevant groups" (p. 72) in order to "encourage innovation, harmonise regulatory regimes to create a genuine common market, and to ensure that regulations are based on rational assessment and well-informed debate" (p. 71).

In part, regulation was sought to allow companies working on biotechnology to exploit the benefits of a unified European market in order to recoup their investments in an expensive sector. The creation, in 1985, of the Biotechnology Regulation Inter-service Committee (BRIC) under the Biotechnology Steering Committee (BSC) – the latter being an organisation functioning as a discussion

[12] "Several areas of industrial microbiology, agricultural genetics and enzyme technology, suffer from the absence in each Member State considered separately of sufficient high level expertise and know-how for undertaking a systematic basis the analysis and control of most complex molecular mechanisms and biological functions upon which the biotechnology of tomorrow will establish it foundations" (p. 19)

forum for the various Directors-General with an interest in biotechnology and established after the October 1983 communication – is a significant signal of the commercial relevance of regulation. BRIC emerged in a context of increasing debate concerning the adequacy of existing legislation in face of emerging or foreseeable developments of biotechnology, such as large scale industrial applications or the release of GMOs into the environment. Among its interventions, BRIC prepared a document in 1986 titled "The European Community and the Regulation of Biotechnology: an Inventory", which was essentially an inventory of existing biotechnology regulation. It was a necessary exercise if Europe wanted to develop a communitarian legislation that could provide the common framework that was necessary for the industrial development of biotechnology. Indeed, the rise of different national legislations would have hampered the establishment of a common European market, the scale of which was a prerequisite for the large investments required by the biotechnology sector. Politically, the Greens were exerting a strong influence on some European governments, particularly Germany and Denmark, which favoured horizontal legislation in contrast to the vertical legislation sought, for example, in the UK. Lack of harmonization would have jeopardised the creation of a common market for emerging biotechnology products.

The opposition of the Greens towards biotechnology was easily justified by the history of the GM regulation in contained environment, which saw scientists being the first to argue for a cautious approach towards the new technology. It is easy to imagine how this approach could have an impact on public perception towards genetic engineering. It was hard to argue for a complete abandonment of controls, especially given the lack of scientific evidence that could formalise the consensus already present within a large portion of the scientific community. It is probably for this reason that after the 1983 Communication, DG XII prepared for the commission a proposal for a "Biotechnology Action Programme" in 1984, which was adopted in March 1985. Cantley (1995) claims that part of the programme "supported the Community first substantial programme of risk assessment research" (p. 540), and that "this work contributed to the initial development of a scientific base of relevance to regulatory needs" (p. 540). This was, however, still a timid response, considering that only ECU 6 millions was allocated to support research on risk assessment, out of a total of ECU 75 millions for the entire programme.

It is also important to consider the contribution of some big multinational companies to the regulatory debate. In 1984 the European Commission invited European big corporations "to discuss the community actions in biotechnology, the nature and mechanisms of the liaison between industry and the commission, and the question of possible needs for a specific bio-industry association" (p. 536). This meeting followed a series of communications such as the COM (83) 672 "Biotechnology in the communty", in which the commission points out the "insufficiencies in the competitiveness of European R&D in modern biotechnology" as compared to the situation in USA and Japan and underlines the dismissive character of US reports on European competitive strength (p. 3). One of the priorities was then to try to create a suitable environment for the creation of a competitive European biotechnology industry that could match that in the US. And one of the first steps was to organise this meeting with industrialists to listen to their perspectives. Among the companies represented there were: ICI, Solvay, Hoechst, Amylum, Akzo. Cantley (1995) describes this meeting as a failure and writes that "the company was mixed, the agenda uncertain, and DAVIGNON was called away – with apologies – to a more demanding engagement after the first hour. […] But on abstractions such as "biotechnology", "rDNA" and "regulation", the discussion was desultory, the participants too high-level to know the detail, and the agenda too vague for them to have been briefed" (p. 536). Nevertheless, that meeting was the result of an acknowledgement of the usefulness of co-operation and coordination, and it certainly represented an impulse towards the creation of EBCG (European Biotechnology Co-ordination Group) in 1985 and ECRAB (European Committee on the Regulatory Aspects on Biotechnology). Both EBCG and ECRAB were part of a larger network of loose industrial, trans-sectoral interactions and were supposed to work as point of contact between the various industrial sectors and the European Commission (Cantley, 1995:536; Goujon 2001: 471-472).

ECRAB was created by the European Branch Federation of Industry in order to respond to the staff of the European Commission who towards the beginning of

1986 invited industry to offer, by the 10th of April 1986, a coordinated opinion on which a proposal concerning regulatory aspects of biotechnology could be based. The participants of ECRAB were:

- AMFEP: Association of Microbial Food Enzyme Products
- CEFIC: European Council of Chemical Manufacturers' Federation
- CIAA: Confederation of the Food and Drink Industries of the EEC
- EFPIA: European Federation of the Pharmaceutical Industries Associations
- GIFAP: International Group of National Associations of Agrochemical Manufacturers

ECRAB produced a position paper titled "Safety and Regulation in Biotechnology". This paper was supposed to represent "the consolidated view of the main industrial groups with respect to industrial application of biotechnology" (p. 1). This paper is particularly interesting because it anticipates some of the parameters of the coming debate on the best regulatory approach on the release of rDNA-containing organisms. The focus of the paper, as suggested by the title, is the definition of a risk assessment procedure in "an area of biotechnology which is of primary concern to both industry and the public, and in which no guide-lines or rules exist" (Executive Summary, p. i) This area is "the planned release into the environment of live organisms that carry a foreign gene or gene component which has been introduced intentionally by genetic engineering technology" (Executive Summary p. i). With commercial pressures pushing towards a rapid development of the GM technology, ECRAB's paper "attempts to formulate proposals on how the risk assessment should be approached and lays down an assessment framework for the release of modified organisms into the environment". ECRAB encouraged the adoption of a "flexible approach in risk assessment which must recognise:

1. the lower risks in controlled, supervised and carefully monitored applications, as compared to higher risks in less controlled field trials and commercial applications.

2. The fact that risks become more defined during the development process from contained to field and commercial applications and that, therefore, a stepwise approach in risk assessment is required.
3. The differences in risks (and, as a consequence, in control measures) in rapidly multiplying live organisms (e.g. bacteria, viruses, fungi) as compared to slowly replicating species (e.g., crop plants or farm animals)."

Given these assumptions, ECRAB proposed a risk assessment scheme based on a system of five consecutive steps that should characterise the development of a project. These steps are:

1. project initiation
2. contained laboratory experiments (*in vitro* and *in vivo*)
3. small scale experiments (closely monitored, non contained)
4. field application
5. Commercial application

In other words ECRAB – the representing body of big European multinational corporations from different sectors – supported a risk assessment scheme devised in incremental steps from the laboratory to commercial applications. The paper also argues that with regard to the first two points extensive experience already existed, and that "guidelines and rules for determining the safety products depend on their final use and must be specific for each industrial sector […] taking into account the different safety requirements and needs" (p. 5). Thus, only the third and fourth stages are those that need to be regulated on a case by case basis. Particularly, the definition of safety precaution measures and the estimation of potential consequences of the release must be determined by use of information about "risk and type of exposure of animals (insects, wild animals, farm animals) and of various crop plants" and "interaction with other relevant component of the eco-system" (Table 2, p. 11). The rules and guidelines developed from the 5 step approach mentioned above were supposed to:

1. “enable European industry to make full and rapid use of the opportunities offered by modern biotechnology, both in terms of new products and of new jobs, but at the same time.
2. recognise the legitimate concern of the public about the potential risks involved.
3. be simple, flexible and comprehensible in order to encourage research maintain the competitiveness of the national (and European) industry vis-à-vis their American and Japanese competitors and to progress in scientific knowledge.”

These last points seem to confirm that regulation was not really sought to guarantee safety, but rather to ease public anxiety that was being exacerbated by pressure generated by the Greens parties and to facilitate the competitiveness of European companies. Despite these efforts very early on by industrial actors, Greens’ initiatives obtained considerable success with the approval of the European Directive 90/220 on the release of genetically modified organisms into the environment, which was based on the precautionary principle (more on the precautionary principle is said in Chapters 4 and 9)[13]. The process of approval saw a bitter conflict between DGXI (Environment) – which favoured legislation for regulating the process of genetic modification through recombinant DNA technology independently of the sector in which the technology would have been employed – and DGXII (Research) – which supported a regulatory approach based on the principle of substantial equivalence, where what matters are the new features of the modified product[14]. Cantley (1995:634) argues that industry did not realise the impact of biotechnology and the effects of Community actions until it was too late to do something significant about it. It is indeed true that industry did not act promptly to the moves of DGXI, but in Chapter 4 I will argue that this was probably not due to an inability to recognise the positive and negative implications of the new technology, but more likely due to the difficulties in identifying a shared interest within a diversified industry in which different

[13] See Levidow (1994) on the development of the 90/220/EEC. Another account of the development of the 1990 Directive on releases of GMOs can be found in Lake (1991). For a short discussion of European regulation of biotechnology see also Balter (1991).
[14] The principle of substantial equivalence was the basis for the regulatory approach on the release of GMOs adopted in the US, as Levidow (1994) has shown.

companies had different, sometimes contrasting objectives[15]. Struggling in identifying shared interests, companies were unable to sustain effective joint action to prevent a given definition of the new technology from crystallising in the Directive. The significance of the Directive in the UK context will be better discussed in Chapter 7.

## *1.5 Back to the UK*

If public reassurance and the competitiveness of industry were important issues in Europe, they were even more so in Britain, a leading country both in scientific and regulatory terms that had much experience to offer to other European countries. In the context outlined in the previous sections, it should not be surprising to see the 'genetic engineering' formula becoming the dominant expression to refer to the new technology. 'Genetic engineering' sounds like a formulation that could reflect a satisfacotry compromise between different institutional needs. With government intervention (or lack of intervention) and companies' new role, the academic scientific community could not claim the exclusive monopoly of practice in the new field. The concept of engineering, with its reference to the possession of professional expertise, probably suited scientists' need to appeal to industry as the providers of a solution to certain problems and to maintain in the meantime the high profile they had in the '70s. At the same time, talking about 'genetic engineering' allowed industry and the government to seek legitimisation from the authority of science, without which they could achieve little public support. The analysis of PROSAMO will confirm these dynamics.

What is really important to emphasise, from what has been said so far, is that 'genetically engineered organism' (or 'genetically manipulated' or 'genetically modified') needs to be seen as a regulatory concept more than a natural kind. Indeed, it is interesting to notice that what was actually covered by the notion

[15] Actually, the social scientist I interviewed was clear about the fact that the 90/220/EEC would have been even more restrictive if big multinational companies had not started to lobby heavily after the content of the first drafts of the Directive became known. The same interviewee also argued that this lobbying was not necessarily positive, in the sense that it might have been easier to relax regulation had it been even more restrictive since the very beginning. This is arguable, as Chapters 7 and 9 will show that rules and principles have nothing inherent in them and that the same principle can be invoked by different kinds of people to achieve opposing ends.

in the UK changed over time, with the parallel constitution of dedicated committee. The fluidity of the whole regulatory panorama and of the conceptualisation of the technology is well expressed by one of my interviewees from Unilever:

> The GMAG was set up in the UK I think it was the first one in Europe actually, to say “well, yes we need to regulate contained use of genetic modification, this is important we need to do this”. And GMAG went on for quite some time. It changed its name to ACDP. The reason I mention this is that they were the group that started to get people wanting to look at releases. You know it was the research, you know, we started with basically regulation for contained use of genetic modification work based on the regulation for microbial pathogens. That’s how it started, so then you go from pathogens to genetic modification and they were quite strict. Eventually, they’ve been slightly...with history they unravelled a little bit what contained level one is and contained level two. And so people were then saying “well we’ve been doing plants. We want to do work in greenhouses but we will eventually want to put this in the ground”. So a small side group from GMAG was set up and around about the, I think mid to late 80s, to address this release issue. So it came out of that…it sprang out of that. And as things moved on that group became the advisory committee, a separate group altogether, out of the GMAG group, and became the ACRE. And the old GMAG group became the ACGM. So you had the Advisory Committee on Dangerous Pathogens as a separate group. So you split up genetic modification from the old pathogens, and then you split the environment from the contained use work.

This quote shows that what constituted genetically modified organisms changed over time with the introduction of new interests. With mainly scientists involved, only the work on pathogens and the contained use needed to be regulated. When moving out of the laboratory and with new actors getting involved, there was the problem of re-defining what aspects of the new technology ware significant for regulatory purposes. This meant aprocess of relabelling of the new technology as well as the new products. It also means that GMOs cannot be perceived as a category that has a precise referent in the natural world. What GMOs stands for in nature had to be negotiated among the social agents holding an interest in doing so.

A good example of the uncertainty in defining what GMOs are is the letter that the Royal Commission on Environmental Pollution sent, back in 1986, to the firms operating in the UK with rDNA technology[16]. The RCEP raised some questions about the release of genetically modified organisms into the environment and invited the Chemical Industry Association (CIA) to submit evidence to the Royal Commission in relation to a study the Commission wanted to undertake. This study would have included all organisms: animals, plants and micro-organisms. Here is the letter in full:

> Dear Diane [secretary, Environmental Committee, CIA]
>
> EVIDENCE TO THE ROYAL COMMISSION ON ENVIRONEMNTAL POLLUTION ON THE RELASE OF GENETICALLY ENGINEERED ORGANISMS TO THE ENVIRONMENT
>
> The Royal Commission, under its new Chairman Sir Jack Lewis, has decided that it should undertake three studies over the next year or so: the release of genetically engineered organisms into the environment; aspects of fresh water quality; and the application of concept of Best Practicable Environmental Option which it has developed over the past few years.
>
> I am writing to invite your organisation to submit evidence for the Royal Commission to consider in its study of the release of genetically engineered organisms to the environment. In this study the Commission will include all organisms: animal, plant and micro-organisms.
>
> This study is being undertaken because the Commission feels that it has special responsibility to Parliament and the public, to make an objective assessment of an issue which is likely to be of growing public concern. By making a timely contribution to public debate, the Commission hopes that its advice will assist the evolution of effective guidelines and controls both in this country and in the European community. In the course of its study the Commission proposes to examine the broad issues such as the risks which could accrue from the environmental use of genetically engineered organisms in the context of the potential benefits; whether current guidelines or regulations are adequate to ensure good practice both in experimental releases and in subsequent

[16] An interesting discussion on the definitional problems regarding GMOs can be found in Nelson (2005).

use of genetically engineered organisms in the environment, particularly with respect to monitoring the dispersion and control of such organisms. In addition to these broad issues, the commission has identified some questions which it expects to address; these are attached in Annex A.

While this letter and its Annex may indicate the aspects of this important topic that have already been identified, they are not an exhaustive list of relevant issues and I stress that the Commission would welcome evidence from you on other questions about the subject that you feel should be drawn to its attention.

In preparing your evidence you may feel able to draw attention to published or readily available material that the Commission would find useful; and it would be of great help to both the Commission and its Secretariat if such material could be identified swiftly, while preparation of special submissions with the opinions of your organisation could take longer. In any event the Commission would be grateful if evidence could be submitted before 31 October 1986.

Evidence and all other communications should be addressed to the Secretary at the above address. It would be of great assistance to the Commission; in planning its business over the next few months, if you were able to let me know at an early date whether or not your organisation proposes to submit evidence; and if it is your intention to do so, the date when the Commission can expect to receive it and the subjects likely to be covered.

Yours sincerely,

(signed) Tom

T E Radice
Secretary to the Commission

The letter of the RCEP included the Annex reported below:

ANNEX A
RCEP Study on the Release of Genetically Engineered Organisms to the Environment

1. The study will distinguish, if possible, between:
    (a) genetically engineered organisms: organisms in which either their DNA has been deliberately modified by using recombinant DNA (rDNA) methods, or genetic information has been exchanged across species by techniques such as cell fusion, transformation, transduction, transfection, conjugation, micro-injection and micro-encapsulation.
    (b) Genetic selection: for example by conventional breeding and selection techniques such as cross pollination of crop plants, or by mutation and selection as with micro-organisms and

(c) Natural selection during the course of evolution.

2. Are there – ecologically, environmental or ethically – any significant differences between releasing the products of 1(a) and 1(b), or indded between these products and releasing exotic organisms obtained by natural selection and released into a new environment, or releasing unnatural concentrations of such organisms?
3. To what extent can replication of rDNA organisms in pre-release studies really predict replication patterns after release into the environment? Is the risk of disrupting ecological systems greater with those organisms that with than with the release of exotic or high concentrations of naturally selected organisms?
4. If an organism performs differently from expectation and disrupts the environment adversely can its control or destruction always be ensured? Is release justifiable if control cannot be achieved?
5. Is the existing legislative framework governing the release of genetically engineered organisms adequate? If not, what changes are desirable and practicable?
6. Should the same rules/guidelines be applied for all releases, or is it possible to differentiate on the basis of scale, environment or the type of organism released? Should there be different regulations and controlling authorities for different uses of released organisms e.g. agriculture or medicine?
7. Is the present practice of case by case review likely to be overwhelmed by an increase in numbers of applications for permission to release engineered organisms? If the present practice becomes unworkable what should be put in its place?
8. How best can the need for public education in both the potential benefits and the potential risks of released genetically engineered organisms in the context of alternative actions be satisfied? What information about specific releases should the public have ready access to?
9. Ownership and responsibility: who should bear the costs of damage attributed to released organisms?

This letter confirms that recombinant DNA technology, by the mid 1980s, was referred to as genetic engineering. It also shows that there are many ways of interfering with genomes, and that at the time it was still unclear whether genetic engineering had to be considered as a distinct category deserving special treatment or not. Chapter 4 will show that this uncertainty is a relevant component of the relationship between experts and other institutions. For the moment, however, it is more important to bear in mind that genetic engineering did end up being considered a special category and one should wonder why this was the case. As this chapter has emphasised, the answer to this question cannot disregard the system of institutional dynamics characterising the regulatory debate around the release of modified organisms into the environment. Unfortunately, the importance of this question and that of analysing the contribution of dominant institutions to the debate, have been rather overlooked by the different approaches that have tried to make sense of the public opposition to GMOs in the UK. These approaches will be discussed in the next chapter.

# Chapter 2 – Elements of the Existing GM Debate: Themes, Frames and Explanatory Resources

The previous chapter introduced the historical background of the GM debate, with a particular focus on the UK context. It has shown how a proper understanding of the debate cannot be achieved without paying due attention to the way the dominant institutions contributed to it. This aspect of the debate however, does not receive enough attention from the dominant accounts of the GM controversy. These accounts are very interesting as they highlight different aspects of the public opposition towards GMOs and, in general terms, they are all correct in identifying risk perception and acceptability as the main issues to be investigated. In their way of doing this, however, they also promote a more or less explicit vision of the relationship between science and society that tends to hide or only partially addresses the role that dominant institutions have played in the debate. The next sections will briefly review the relevant literature on risk perception and will analyse the vision of society expressed by the different approaches while making sure to highlight the connections between these perspectives and the GM debate as it has developed in the UK. The limits of these accounts will be discussed and an alternative approach will be introduced – an approach that will provide the necessary tools to understand the process of institutionalisation of GMOs.

## *2.1 The Cognitive Approach to Risk*

One widely accepted definition of risk is the following: risk is the probability of a given event taking place multiplied by the damage it can cause (see Royal Society, 1992). This definition interprets risk as unambiguously quantifiable and is the backbone of one of the most popular perspectives on public perception of risk, one which has significantly influenced its management. Its main proponent is Chauncey Starr (1969), who claimed he could determine the acceptable level of risk in one area by comparing its rate of mortality with areas where risks were accepted. The introduction of a new technology should not bother people if the frequency of fatalities is inferior to the one associated with, for example, driving a car, a risky activity that people seem to be willing to undertake. Only lack of proper information on the technology and its level of risk can explain non-cooperative behaviour among the population; this behaviour is then regarded as irrational. Together with the level of deaths, Starr introduced a voluntary/involuntary dimension for the determination of acceptable risk. This is to say, given the same incidence of fatalities, involuntary risks are much less acceptable (for a brief discussion on Starr, see also Turner and Wynne, 1992). The following are his conclusions:

> (i) The indications are that the public is willing to accept "voluntary" risks roughly 1000 times greater than "involuntary" risks. (ii) The statistical risk of death from disease appears to be a psychological yardstick for establishing the level of acceptability of other risks. (iii) The acceptability of risk appears to be crudely proportional to the third power of the benefits (real or imagined). (iv) The social acceptance of risk is directly influenced by public awareness of the benefits of an activity, as determined by advertising, usefulness, and the number of people participating. (Science, 1969, p. 1237)

It is easy to see why this approach has been branded "cognitive" (Irwin and Michael, 2003) by its critics, given its emphasis on cognition as an instrument for generating public support for new technologies. This approach, as stressed by some scholars (Wynne, 1992; Irwin and Wynne, 1996; Bucchi, 2003; Irwin and Michael 2003), is at the basis of the realisation of the 1985 Royal Society report *The Public Understanding of Science*. This report has since the end of the 1980s stimulated a series of initiatives aimed at determining the level of scientific competence of the population, both British and European, through the distribution of questionnaires to a representative sample of individuals. The survey undertaken by Durant (1992) and the Eurobarometer surveys on biotechnology (e.g. Marlier, 1992) are often taken as examples of this cognitive approach with regard to the GM debate.

## 2.2 The Risk Society

The cognitive approach has been heavily criticised by Ulrich Beck (1992a; 1992b), arguably one of the most representative interpreters of contemporary

Western society who has obtained great visibility since the late 1980s with his *Risk Society: Towards a Reflexive Modernisation*. Beck (1992b) argues that we live in a society where the risks we face have a different nature to the risks characterising pre-industrial, traditional societies. More precisely, the main feature of contemporary risks is their invisibility. Risks cannot anymore be perceived through the senses, but only through the instruments of science, and often only after the damage has occurred. In the identification of risks then, we can only rely on risk definitions that are inevitably linked to particular political and economic interests, as well as to ethical considerations. Beck summarise his position in the following way:

> [Risks] can be changed, magnified, dramatised or minimised within knowledge, and to that extent they are particularly open to social definition and construction. Hence the mass media and the scientific and legal profession in charge of defining risks become key political positions. (p. 23)
> […]
> In modernisation risks then, things that are substantively objectively, spatially and temporally disparate are drawn together causally and thus brought into the social and legal context of responsibility. […] presumptions of causality escape our perception. They must always be imagined, implied to be true, believed. In this sense too, risks are invisible. […] (p. 28)

For this reason, the division of the world between experts and non experts that characterises the cognitive model so well illustrated by Starr and which tends to picture normal citizens as ignorant and therefore irrational, cannot explain the public negative attitude towards science and technology.

> This division of the world between experts and non experts also contains an image of the public sphere. […] In this view, the population is compared to nothing but would-be engineers, who do not yet possess sufficient knowledge. They only need to be stuffed full of technical details, and then they will share the experts' viewpoint and assessment of the technical manageability of risks, and this their lack of risk.

> Protests, fear, criticism or resistance in the public sphere are a pure problem of information. (pp. 57-58)

The invisibility of risks has undemined the monopoly of science on rationality, giving in this way room to contradictory risk definitions which rise from the necessity for answering the following question: *how do we wish to live?* Beck argues that the answer to this question cannot come exclusively from science, but also from what he calls “everyday rationality”.

> Risk determinations are an unrecognised, still undeveloped symbiosis of the natural and human sciences, of everyday and expert rationality, of interest and fact. […] They require cooperation across trenches of disciplines, citizens’ groups, administration and politics, or – which is more likely – they disintegrate between these into antagonistic definitions and *definitional struggles.* (p. 28-29)

As a consequence of modernisation then, science has lost its monopoly on rationality. On the contrary, there is much more room for different interpretations of reality. From this point of view, the opposition towards techno-scientific innovations cannot be attributed to the irrationality of individuals. Instead, Beck states that this opposition can mean that the cultural assumptions about risk acceptability contained in techno-scientific claims are wrong (p. 58).

## *2.3 The Lancaster School*

Beck’s work has many points of contact with the studies conducted by Brian Wynne and colleagues in the UK, to the point that it could be possible to interpret Wynne’s intellectual path as the empirical arm of the more general and abstract literature on the risk society. Beck and Wynne have in common an explicit opposition to the cognitive version of the relationship between science and society. For example, Turner and Wynne in 1992 write:

> […] information campaigns should always where feasible be accompanied or preceded by other activities. This would include social

> research of the kind referred above, but might also mean open-day public access to sites and staff, smaller-scale meetings where representatives of organisations are available for questioning, and other more interactive methods. (p. 133)

This last quote clearly reflects the deeply felt need for a new model for studying the attitude of the public, an approach that Irwin and Michael have branded “qualitative” or “ethnographic”, in opposition to a “quantitative” model based on surveys aimed at obtaining information about the level of scientific competence that interviewees possess. The famous ethnographic study conducted by Wynne (1992) of the relationship between governmental experts and a small community of sheep farmers in a region of England after the Chernobyl accident is a milestone in the STS literature. It is not necessary to repeat here what other scholars have said about it (Irwin and Michael, 2003; Collins and Pinch, 1998). What is important to underline here is that, in line with Beck’s vision, Wynne and colleagues suggest that risk is perceived on the basis of trusted local and familiar contexts which are threatened by the way the dominant institutions deal with and manage risk[17].

Also in accordance with Beck, Wynne and his collaborators argue that the experts’ attitude to technical issues is a reflection of an authoritarian approach, which is often masked or even legitimised by a reductionist and instrumental rationality that characterises the dominant culture of risk analysis and assessment. Costs and benefits are perceived as the only important elements in scientists’ discourses. According to scholars like Turner and Wynne (1992) however, the structural features of risk – as identified by Beck, for example – highlight the need of trust in other social actors beyond the recognised professional experts, to the point that universalistic claims tend to lose credibility. In the authors own words:

> These structural features amplify the need for trust in other social actors, ironically at the very time that individualism and instrumentalism are otherwise encouraged. Universal claims and programmes of all kinds

[17] Wynne’s work on risk perception has become very influential and has inspired a whole series of initiatives, especially in the UK, like the GM Nation debate. For an alternative view of risk and its perception see Margolis (1996)

> undermine their own credibility in these circumstances, as the particular realities of local situations – those which the standardising tendencies of modernism ignore – are given privileged standing. Whatever their specific aims, communication programmes cannot afford to ignore this more diffuse, but fundamental social existential basis of risk in modern society, whose fragmenting processes put people's very identities at risk. (p. 131-132)

The solution to this social impasse is, as argued by Lash and Wynne (1992), the willingness of scientists to be reflexive:

> A reflexive learning process would have recognised the conditions underpinning the scientific conclusions, drawn out the social questions which they implied, and examined these with the benefit *inter alia* of the different forms of knowledge held by people other than scientists. This reflexive learning process would have necessarily meant negotiation between different epistemologies and subcultural forms, amongst different discourses; and as such it would have entailed the development of the social and moral identities of the actors involved. (p. 5)

In other words, the supporters of Beck's approach, such as Wynne is, believe that this veiled authoritarian attitude is fairly widespread within the scientific community – an attitude that neglects the different identities that contribute to the definition of reality – and is the cause of the difficulty scientists and dominant institutions have in re-building a trust relationship and restoring their credibility in the eyes of citizens. Scientists' instrumental rationality, according to their critics, does not reflect the different needs of various social groups and Starr's conclusions (i.e. that one should be willing to accept certain risks if these are similar to those faced when, for example, driving a car) are misleading. As pointed out by Turner and Wynne (1992), some people may believe that they have no other choice than to drive their car, and that they reluctantly do so because they feel there is nothing they can do to change this situation.

## *2.4 The GM Debate in the UK*

The contrast between the cognitive/quantitative and the ethnographic/qualitative approaches has also developed during the debate surrounding GMOs in the UK. As already mentioned in the previous sections, since the beginning of the 1990s surveys have been commissioned at both the European and national levels to test the attitude of the public towards GMOs. But this way of investigating the public's attitude has been strongly criticised. Irwin and Michael have criticised the cognitive approach for making scientific literacy a necessity for a participative role in decision making in science and technology. The consequence of this vision is quite clear: a good citizen is the one who enters the political arena well informed and well equipped from a cognitive viewpoint. One should participate in the debate on the basis of "universal accredited knowledge", that is, knowledge that is described as a "homogeneous, unitary entity called biotechnology or genetic engineering with definitive biotechnological principles, procedures, knowledges – a domain within which any listed topic can be defined as either 'in' or 'out'" (p. 25). This has the consequence of conglobating within the label 'biotechnology' practices that are "likely to be perceived as being associated with different more or less credible institutions, legislative regimes and potential risks" (p. 25).

The qualitative approach in the context of the UK GM debate finds its first empirical expression towards the middle of the 1990s with *Uncertain World* (1997), a study from the Centre for Environmental Change, University of Lancaster, in collaboration with Unilever and Green Alliance. *Uncertain World* is the first of a series of initiatives that sees the Lancaster School dominating the discussion about the public perception of GMOs.

*Uncertain World* (UW), by Grove-White, Phil Macnaghten, Sue Mayer and Brian Wynne, explicitly distances itself from the previous attempts to investigate the attitude of the public towards GMOs, centred on the questionnaire approach, the methodology of which:

> whilst generating important indicators of public views, is generally unable to illuminate the deeper reasonings and contextual understandings which underpin such responses. (p. 4)

The research consisted of nine focus groups that reflected various social groups. Its report directs our attention to "questions concerning the public acceptability of such products [GM products], and the adequacy of existing political and regulatory management for addressing actual and latent public concerns about GMOs/biotechnology". In particular, it highlights people's considerable ambivalence – at least at the time of the study – towards GMOs in food products. During the discussions of the focus groups, the constant reference to the BSE crisis and to the way institutions managed the situation revealed that "much of the unease about biotechnology uncovered in the groups are important questions of *trust*" (p.19). In other words, "the discussions provided copious indications of mistrust of official institutions" (p. 19).

According to the authors, the origins of this mistrust should be sought in the inherent limits of the UK risk assessment culture. With its emphasis on 'sound science' and overconfident official "body language", with its quantitative, reductionist-scientific modes of risk evaluations, the UK institutions, particularly the government, have in fact reduced "complex and multidimensional risk questions into hard and precise scientific parameters", so excluding other dimensions like the cultural and social context. According to this approach, the dominant institutions should take into account the basic role that uncertainty plays in the way people perceive risk. In a nutshell, the anxiety of the public towards techno-scientific innovations is linked to a widespread, double awareness among individuals: that everything we try to know is uncertain and that experts' ability to manage this uncertainty is limited. Thus, the anxiety towards new technologies would be due mainly to the contrast between the awareness that our knowledge of the world is uncertain and a communication of risk in which the dominant institutions adopt an overconfident body language which is far from being credible.

The main consequence of this new way of exploring and interpreting the public's attitude should be the emergence of a new kind of relationship between institutions and the lay public – a relationship that will allow the public to play an active role in the development of science and technology. Using the authors' own words, the report proposed:

> An urgent two-year programme of institutional experiments, aimed at greater involvement of the public, in order (a) to develop more socially resilient shared understandings of the conditions of acceptability (or otherwise) of GMO foods, and (b) to improve the 'social intelligence' of industry and Government vis a vis relevant public sensibilities and concerns. (p. 2)

These institutional experiments should include: regional consensus conferences; regional citizen panels; focus group discussions targeted on specific product classes; national workshops.

It is clear that compared to Starr's position and to the survey approach, both fundamentally centred on the cognitive limits of the public, the "qualitative" approach represent a step forward in the problematisation of the concept of 'public'. The analysis of the public offered in UW is certainly more refined when it shows that, in expressing their opinions about biotechnology and GMOs, "people drew on contextual knowledge of distinctive kinds" (p. 17). Aaccording to the authors then, the dominant institutions fail to understand that the public rely upon different kinds of knowledge, which do not simply coincide with technical or scientific knowledge. A much wider research project (PABE, 2001), once again conducted by the Lancaster University with the collaboration of other institutes and scholars around Europe and under Wynne's direction, has shown how the opinions of people are fundamentally driven by different forms of knowledge:

1. non-specialist knowledge
2. knowledge about human fallibility
3. knowledge about (institutions') past behaviour

Besides representing a more refined analysis of the public, the approach in UW helps to move our focus on the scientists and thus to problematise their role in the relationship between science and society. More precisely, as usefully pointed out by Irwin and Michael (2003), under investigation is also the 'scientific understanding of the public' rather than just the "public understanding of science" (see also Grove-White et al. 2000).

## *2.5 Uncertain* Uncertain World

The previous section has focused mainly on the novelty represented by the qualitative approach. This does not mean, however, that it is immune from problems and deficiencies.

### 2.5.1 The Problem of Successfulness

The first limitation of the qualitative approach represented by UW concerns its successfulness. In the context of the GM debate, UW was aimed at developing a better understanding of the conditions of acceptability of biotechnology in order to improve the 'social intelligence' of industry and the Government. This was in order that the institutional handling of the social implications of the new technology could be improved. This being – at least formally – the objective of the qualitative approach, it is clear that it has not been particularly successful, as many stakeholders would probably recognise. Some observers, such as Irwin and Michael (2003), would probably argue that this lack of success is the outcome of the ambivalent attitude of scientific and regulatory institutions who adapted their rhetoric to the 'public participation' or 'public engagement' framework without really changing the substance of their attitude. This created a constant tension between the authority of science and the perceived necessity to include and integrate public values and views in risk assessment. This account, however, fails to explain why studies like UW did not contribute to changing the attitude of the regulators. Why did the hoped for improvement in the social intelligence of dominant institutions not take place? Maybe, in line with the qualitative approach argument, one should wonder if there is a faulty social scientists' understanding of their public – that is of policymakers and regulators.

### 2.5.2 Science vs. Society

A second problem with studies like UW, as stressed by Bucchi (2003), is that they tend to create the idea that science and the public work in opposition to one another. The emphasis on the analysis of local contexts and of atypical cases as well as the inclination to more or less explicitly generalise from these analysis feeds the misleading idea that science and society are not trusted anymore, and that technological innovations almost inevitably become a social problem. This position is debatable. In a society like ours – characterised by a high level of specialisation and differentiation – it is surprising to see how smoothly things generally work after all. Durkheim (1964) had noted this towards the end of the nineteenth century, when he argued that modern society is dominated by organic solidarity, a sort of mechanism imbued with mutual trust within a constant exchange of competences and knowledge. In a context so heavily founded on trust, it is very easy to notice when things do not work according to expectations. Mistrust is like a black spot on a white wall. It is easy to identify, but it does not constitute the norm if one looks at the wider picture.

It is instead interesting to notice how public attention if often focused on a relatively small number of technological innovations. In the case of biotechnology, for example, only a few of its possible applications are subject to criticism. The model proposed by Hilgartner and Bosk (1988) helps to better understand this phenomenon. Their model emphasises the competition between different social problems –a social problem being any situation that is perceived and defined as problematic by an individual or a group. This competition springs from a double constraint: (i) public attention is a scarce resource and (ii) public arenas, where public discourses take place, have a limited carrying capacity and can therefore deal with a limited number of problems at the same time. Proponents of different social problems must compete for visibility by developing a series of rhetoric devices that fit with the selection principles characterising the specific arenas. This model may explain why only a limited number of scientific issues become problematic. Scientific problems have to fight with numerous other problems and there is not enough room in each arena to deal with all the situations that can be perceived as dangerous or problematic by different social actors. Moreover, the public arenas model can explain why public resistance to new technologies, or better, why the number of social problems associated with scientific and technological innovation, may have increased. Technological advances in the mass media system have increased the carrying capacities of many arenas, increasing as a consequence the opportunities a problem has for becoming visible. These technological advances have also increased the access of the public to information. This, together with mass education, may have endowed the public with the cognitive analytical tools capable of managing this information more effectively and with more scepticism (see Barnes, 2005; see also O'Neal, 2002).

It could be also underlined that overemphasising the contrast between science and society may end up obfuscating the not infrequent cases in which the categorical distinction between science and society, between experts and non-experts, is actually supported by members of the lay public itself. Epstein (1996) for example, has clearly shown that some members of the public have had to become lay experts in order to engage in a negotiation with scientific institutions in relation to the development of experimental protocols aimed at researching a cure for HIV patients. Michael (1996) has demonstrated that people can articulate their ignorance in quite sophisticated ways. On some occasions, people present themselves as being mentally incapable of understanding the technicalities of scientific discourses. On other occasions, their not knowing the science is described by lay people as being part of the complicated and highly specialised organisational structure of society in which science and other activities are functional to each others. In other words, there is complementarity between the work of scientists and other professions. A third articulation of ignorance implies that scientific knowledge can be deliberately ignored because it is peripheral or irrelevant to the issues at stake or to the activities undertaken. In all these case, people implicitly support the categorical distinction between lay knowledge and scientific and technical one, they replicate it in their discourses about their own identity, and often they even explicitly recognise science as having a higher status. As argued by Bucchi (2003), the critical approach to the public understanding of science encounters a double limit: on the one hand, it conceals the fact that even lay knowledge is characterised by internal conflicts, contradictions and multiple interpretations; on the other hand, it conceals that those local identities and their contextual lay knowledge are actually part of a wider system of socio-cultural interactions.

### 2.5.3 The Problem of Uncertainty

There is another important limitation of the way Wynne and his associates describe the relationship between science and society, something that has not been given sufficient attention up until now. In UW, as already mentioned, the anxiety of the public towards techno-science is the result of a widespread awareness that human knowledge of the world (including experts' knowledge) is uncertain, combined with the fact that this uncertainty tends to be neglected in the words and attitude of the dominant institutions. There are two main difficulties in such a description. On the one hand, the concepts of risk and uncertainty are used problematically and unsystematically; on the other hand, no evidence is offered, at least in the context of the UK GM debate, of this "overconfident" institutional body-language. The only proof of this institutional attitude comes from the words of the participants of the focus groups who refer primarily to the BSE crisis.

#### 2.5.3.1 Uncertainty

In UW, the concepts of risk and uncertainty are not clearly defined and problematised, but it is reasonable to assume that there is some coherence in the way the two concepts are used in Wynne's work. I will therefore refer to one of his essays, published in 1996, thus in temporal proximity to UW, in which the two concepts are used at the same time:

1. Most risks are actually intellectual constructs which artificially reduce larger uncertainties to ostensibly calculable probabilities of specific harm. [...]
2. Given these kinds of uncertainty it is rational of people not to limit themselves to assessing the magnitudes of claimed risk that exist, because such estimates will always be subject to larger uncertainties

> indicated above. It is instead logical for them to ask, how trustworthy are the institutions supposedly in charge? (p. 57)

It should appear clear that this way of using the concepts of risk and uncertainty is inappropriate. Generally, we talk of uncertainty when we know some outcomes will occur with a probability that cannot be estimated. The words "reduce larger uncertainties" then become problematic because, by definition, we cannot attribute magnitude to uncertainties. Even assuming that it was possible, in some general sense, to quantify uncertainty and classify different uncertainties in relation of their 'dimension' on the basis of our current knowledge, even this classification would be subject to uncertainty exactly because the knowledge used to determine the 'degree' of uncertainty could be wrong. From this point of view, estimates of uncertainties could easily be much more conservative than they shouldbe and that a given technology may actually be much safer than expected.

Under this new light, the argument in UW becomes more difficult to interpret because the concept of uncertainty is used in an ambiguous way. Actually, this use of uncertainty does not seem to sufficiently differentiate it from the concept of risk that is criticised. This problematic use of uncertainty has led observers like Barnes and Dupre (2008) to argue that it has in fact become a powerful but at the same time misleading rhetorical device[18]:

> We tend to find in practice that first of all the existence of uncertainty is proclaimed in some domain or other – which can scarcely be denied – and then the uncertainty is subtly converted into a sense of risk, typically by use of tenuous and contested analogies. (p. 249)

A second problem in Wynne's interpretation of the concepts of risk and uncertainty is that it does not take into account their malleability – that is, the fact that they can be used in different contexts by different social actors. Uncertainty can be easily used as a powerful tool to oppose given interpretations of the world, thus making the concept of risk central. The work

[18] On the use of uncertainty in controversies see also Campbell (1985).

of Mary Douglas (1992) addresses this point in an interesting way. On risk, she claims the following:

> When we ask why risk has become central to our behaviour the answer has something to do with our moving into a global society. [...] Industrialization draws members of small communities into larger regional, national and international spheres. For new social relations they need new concepts, new words, new schooling and new loyalties to bring themselves up to the appropriate level of inter-community discourse. [...] To move out of the local community means defying its tyranny. [...] I would add that the liberation from the small community also means losing the old protections. [...] We feel vulnerable. [...] Some generalised weapon of defence will be required, to fill the needs of justice and welfare. (p. 15)

The idea of risk, with "its universalizing terminology, its abstractness, its power of condensation, its scientificity, its connection with objective analysis" (p.15) is the perfect tool for this protection. It is exactly because of its abstractness and reductive nature that we can provide different interpretations of the world around us. As Douglas and Wildavsky (1982) have put it, "we are entitled to a different view just because knowledge is limited, alternatives imperfectly understood and consequences disputed" (p. 22). In other words, uncertainty can free us from interpretations of reality that are imposed on us, and the language of risk can provide the alternatives. This is what environmental groups often do, especially if they are required to move beyond local contexts involving cultural realities that can be very different from each other[19]. In Durkheimian terms (Durkheim, 1965), risk becomes a sacred object that is abstract enough to keep together very divers groups, but it is at the same time concrete enough to make its use for specific goals possible.

Wynne and Douglas obviously share the idea that people turn to the organisations they trust when they have to make a choice. But while trust is for

[19] On the partisan use of technical expertise in controversies about technology see the work of Nelkin (1975, 1982, 1992). More generally on expertise as the outcome of an extensive process of socialisation of individuals within a particular community and its interests, see Collins (1974, 1992). For an expanded reflection on expertise(s), see Collins and Evans (2007).

Wynne the end of a decision making process that has its origin in people's awareness of uncertainty, for Douglas trust is the starting point. According to Douglas, beliefs about nature, and therefore about risks and uncertainty, are selected in order to justify an established or desired way of living together with its pattern of social relations. For Douglas and Wildavsky, "the choice of risks and the choice of how to live are taken together" (p. 8). People, under this perspective, become more or less aware of certain dangers as part of conforming with an existing or desired lifestyle, with a preferred organisation of social relations. This organisation provides order and restrictions, allow some actions instead of others, selects certain risks but not others, creates expectations, high degree of conformity and solidarity within a group. Different forms of social organisations, they argue, provide different theories of "how society should be organised and a set of smooth grooves into which a lifestyle can be cast. Each also provides an explanatory philosophy to justify it" (p. 174-175).

According to Douglas then, "the reality of the dangers is not an issue. The dangers are too horribly real […]. This argument is not about the reality of dangers, but how they are politicised" (1992: 29), that is, the way some risks, and consequently the uncertainty that makes them possible, are used to achieve specific goals. In the preface of the 2002 edition of her *Purity and Danger*, Douglas describes her approach to the study of risk in the following way:

> Naming risk amounts to an accusation. The selection of which dangers are terrifying and which can be ignored depends on what kind of behaviour the risk-accusers want to stop. (p. xix)

The entire process of the selection and institutionalisation of risks and uncertainties can be summarised with the words Douglas (1987) uses when she more talks about institutions in general:

> This is how the names get changed and how people and things are rejigged to fit the new categories. First, the people are tempted out of their niches by new possibilities of exercising or evading control, then

> they make new kinds of institutions, and the institutions make new labels, and the labels make new kinds of people. (p. 108)

An interesting aspect of this last quote is the emphasis placed on both the exercise of and the evasion of social control. In Wynne, uncertainty tends to be exclusively associated with forms of evasion of the social control exercised by dominant institutions, while for Douglas, categorising something as uncertain or risky can also become a way through which power is maintained and the status quo reproduced[20]. The focus is thus not just on evading control, but also on finding new ways of exercising it. This important qualification is in line with Douglas' attention to industrialisation and the ever-increasing division of labour in contemporary western societies. The division of labour has made the struggle for power and control more dynamic than ever. In this context, for dominant institutions to survive they need to keep changing themselves as new organised competitors threaten the established structure of power. The market represents a very promising place to spot these dynamics. Companies are constantly striving to ensure that their products are innovative. They change their internal organisation or modify their communication strategies so that they can maintain a competitive advantage (see Barnes, 1995). Change is then a key factor in the survival and maintenance of the status quo and risk definitions need to be understood within this dynamic framework. The perception and definition of risk and uncertainty depend on interests that are associated with a given lifestyle. These interests depend on the position a cluster of individuals occupy within the social structure and any opportunity to exercise or evade control will be exploited to promote them.

One last problem deserves treatment. The previous sections illustrated how the attention on calculable risks and the provision of technical information to the lay public characterised the cognitive approach to the problem of the public understanding of science. This perspective, as I have emphasised, has been strongly criticised and described as a form of domination. As a consequence, the ethnographic approach moves from the concept of risk to the concept of uncertainty, which is used as an expedient to move the focus from cognition to

[20] For a series of examples on how ideas of nature are used to maintain social control see Douglas (1982).

the problem of trust and credibility. However, if one pays due attention to questions on trust in the first Eurobarometers (e.g. Eurobaromenter 35.1) on genetic engineering, it is clear that the so called “cognitive” view is not exclusively cognitive after all. It also introduces another dimension to the study of risk perception in the GM debate, the relational dimension. For the cognitive approach it is not simply a matter of what people know, but also a problem of how they relate to a variety of institutions and organisations. This interest in the relational dimension is often underacknowledged by the critics of the cognitive perspective, but it is actually very important. The Eurobarometer questions about trust represent an adjustment in knowledge of society, knowledge that is explicitly aimed at changing social practices. In Barnes’ words (1988):

> But to learn about our own society may be to change that society, since in learning we change ourselves and we are part of our own society. (p. 53)

It is therefore possible to say that through instruments like the Eurobarometer, the institutional social actors have undertaken a process of social learning and in doing so they have change their own practices and the ways in which they relate to the world and to other social actors.

#### 2.5.3.2 Lack of Evidence

All these considerations lead to the second shortcoming identified in UW. The analysts who wish to understand the reasons behind public opposition towards science and technology, and in our particular case towards GMOs, cannot limit themselves to the study of the public, but also needs to observe the way dominant institutions manage techno-scientific innovations. It is true that UW mentions an over-confident institutional bodylanguage as one of the main reasons for the public’s negative attitude towards GMOs, however no proof is offered to support this interpretation. The only evidence offered to sustain this position comes from the words of the participants to the focus groups who mainly refer to the BSE crisis. It is of course possible to argue, as Wynne and others do (see PABE, 2001), that people’s experience of institutional behavior may have an impact on how willing they are to trust those institutions. But this experience needs to be checked against the background of the actual institutional dynamics that have taken place in that particular sector, especially Irwin and Michael (2003) are right to say that we should be careful not to conglobate practices that are likely to be perceived as belonging to different domains by the lay public (section 2.4). The sociological/institutional model laid out by Doulgas and Wildavsky (1982) justifies a more careful look at the institutional dynamics that characterized the UK GM debate. The next chapters will explore these dynamics through a detailed discussion of PROSAMO (Planned Release for Selected and Modified Organisms), a scientific initiative that consisted of a series of experiments undertaken between 1989 and 1992 and aimed at determining the environmental impact of releasing GMOs, both plants and microbes. PROSAMO was jointly funded by a consortium of chemical and food multinational companies and the UK government (through the Department of Trade and Industry), and they hired some university departments to do the experiments. The significance of this initiative derives from it being the first institutional attempt to regulate the release of GMOs into the environment in the UK. Many of its participants have gone on to play an important role in the debate since the conclusion of PROSAMO.

## *2.6 The Grid/Group Model*

Douglas lays out a very dynamic, flexible framework when she suggests that the definition and perception of risk are the expression of pragmatic interests associated with an established or desired way of life. However, in the effort to generalise and to give order to her observations through her known grid/group model, she fails to maintain this flexibility alive, or at least she is not clear about it[21]. According to the grid/group model, each society is characterised, and probably sustained, by a constant struggle between four different forms of social organizations that give rise to different, contrasting ideas about how the world is.

[21] Douglas' grid/group model was originally designed to classify societies according to their structural features. Its employment in the study of risk is an adaptation of this earlier thinking. See Douglas (1973, 1978). Other contribution by Douglas on risk can be found in Douglas (1986, 1990, 1997).

Douglas builds a scheme constituted of four kinds of social organisations distributed along two axes. The horizontal axis, the “group”, indicates the strength of group boundaries under external pressures. In other words “*group* means the outside boundary that people have erected between themselves and the outside world” (Douglas and Wildawsky, 1982: 138). The vertical axis, the “grid”, represents “all other social distinctions and delegations of authority that they use to limit how people behave to one another” (p.138). This last dimension reflects the extent to which people are constrained in their behaviour by social norms and sanctions. Each of these social organisations is then associated with a specific set of cosmological beliefs about nature, time and future, the good society and humanity

The high grid/high group type of social organisation, labelled – probably misleadingly – “hierarchist” is characterised by a strong group identity and high level of internal control maintained through division of labour based on a variety of criteria. People within this context value tradition and the order provided by established organisations, can afford long term objectives because they believe that their traditional way of life will hold in the future, are not particularly competitive because little individual glory is conceded and, accordingly, blame is distributed across the components of the system. It is in their character to slow down the pace of change because “new resources upset the pattern of distribution [of wealth]” (1982; p. 180), even though the constant attacks from other cultural types force them to deal with change and channel it. Whenever possible, these changes will be inscribed within the frame of tradition.

Change is instead an explicit vital component for the life of those who endorse the low grid/low group kind of cosmology, those who feel little or no group identity and support and reject any significant external constraints upon their activity, the individualists. These are the entrepreneurial individuals who see risks and uncertainties as an opportunity for making profit as well as seeing them as dangers.

Hierarchists and individualists are considered the dominant forms of social relations within a society and can establish synergies with each others. As

Douglas (2003) puts it, “a limited coalition between the two cultures, individualist and hierarchist, is needed for the organization of the community. They are allies and rivals at the same time” (p. 1358).

At the low grid/high group level there are the egalitarians. These are people who focus on equality among individuals. For the sake of equality, they tend to live according to a simple lifestyle supported by complicated rules that avoid an unequal distribution of power and resources to be established. They are naturally opposed to the inequalities that are inherent in hierarchists’ and individualists’ dominant ways of life. They are the “border” that challenges the “centre”. The egalitarians then constitute the dissident communities based on voluntary association, which is best managed if the community is small:

> A losing battle against the difficulties of voluntary organization presses its members into rejecting increase of scale, preferring egalitarian rulings and attempting closure against the rest of the world. (Douglas and Wildavsky, 1982: 121)

Given the focus on smallness of scale and equality, it is not surprising that this kind of organisation will be subject to frequent schisms. It is now easier to understand what kind of risk portfolio egalitarians will support. If the centre emphasises, for example, technological change in order to maintain its grip on power, it is likely that technological change will be targeted as dangerous and imminently disastrous regardless of claims of a low probability of negative consequences. More generally,

> More than anything else, [in a modern society] technology represents social distinction, the division of labour, the making of wealth and everything that is prized by the center” (p.124)

The emphasis on equality also pushes egalitarians to talk on behalf of humanity. The selection and definition of risks will then be global rather than local because they need to affect everybody alike. Environmental issues are particularly valuable from this point of view. Damage to nature produced by the “big technologies” employed by the centre is the main source of concern and risks are identified within this logic.

The last social type is defined by the fact that people belonging to it tend to accept a high level of constraints upon their behaviour – constraints that are imposed by the centre of the society – but tend to lack strong group identity. They think they have little impact on the state of affairs anyway and prefer to refer to luck or destiny when dealing with unfortunate circumstances. If something goes wrong they blame bad luck or say that if it had to happen it would have happened anyway. This social type has been frequently ignored by analysts employing the cultural theory approach because they were thought to possess little political weight. But Douglas (2003) acknowledges that they can have a great impact as an uncoordinated mass. The functioning of the media, she claims, has often sought the support of the mass for its success. Douglas also claims that paying attention to the “fatalists” or the “isolates” – as she calls them – would increase the depth of the interpretation of surveys, especially when the number of “Don’t Know” responses is high.

> The ambivalent response to questionnaire, “Don’t Know” is very instructive. Sometimes it means, “Don’t Care”. Among other things, it reveals the strength of the preferences for each sector in the cultural theory model. (p. 1370)

As shown when discussing Michael (1992), spending some time looking through the “Don’t Know” answers is very instructive indeed.

Given the constant struggle between social types, society needs to be conceived as a continuous adjustment in the definition of reality. The dominant social types constituting the centre, the hierarchists and the individualists, will keep changing themselves and their definition of reality in order to respond to the (actual or foreseen) attacks of the border social types, the egalitarians in particular.

Despite the simplicity and appeal of the grid/group model[22], this way of conceiving society partly contradicts Douglas' theoretical foundations. As pointed out by Lupton (1999), this "cultural/symbolic approach emphasizes that risk judgements are political, moral and aesthetic" but she also recognises that "this model may be subject to criticism for its apparent rigidness, static nature and inability to account for the ways in which most individuals constantly move between the four worldviews, rather than belonging to one or the other" (p. 51). This is not to suggest that Douglas' terminology is to be discarded, but in my view a more dynamic interpretation of its use needs to be envisaged.

Barnes, Bloor and Henry (1996) illustrate this last point when they discuss Henk van den Belt's (1989) study of the patent dispute concerning the red dyes derived from aniline. The authors found the example instructive for outlining their ideas concerning social action, "which is to be understood as purposive and goal oriented" (p. 121).

> What now might be said of goals and interests operative in our example? First of all, they are social goals and interests, associated not with given individuals but with their place in a pattern of social relationships. The lawyers beautifully symbolize this point: each individual lawyer presented a received brief, but would as happily have presented the opposed brief if circumstances had linked them to it. Second, whilst we have two factions with opposed interests, the interests are not those of social groups. Individuals of the same group are divided by conflicting interests here, and individuals of different groups are united by shared interests. In each faction a cluster of individuals from different groups, and all with different goals, have an interest in the same judgement because it furthers all their separate goals alike, and is the route to achieving all of them. (p. 123)

[22] Douglas' model and terminology has been adopted by various scholars to describe risk, for example Adams (1995) and Schwarz and Thompson (1990). The latter will be briefly mentioned later in this chapter. The argument about risk promoted by Douglas has been persuasive enough to encourage the Royal Society (1992) to spend a few pages discussing the way risk has been interpreted by Cultural Theory.

This example is interesting for two reasons. On the one hand, as suggested by Lupton (1999), it shows how belonging to one social group does not inevitably determine one's responses towards the world. On the other hand, this way of treating interests and of distinguishing them from individual wants and desires is very important and reflects the flexibility we need to understand social action. It is easy to spot a similarity between the previous quote and what Douglas is trying to say in *How Institutions Think* (1987:108) – that is, that the categories we use to think are shared, but that they also serve our interests, interests that emerge as collective definitions of the public good that are enforced and sustained by individuals who constantly keep each other under control as members of specific social networks. In line with the quote from *How Institutions Think* reported above (p. 54), Barnes, Bloor and Henry (1996) (but see also Barnes (1977) or Barnes (1995)) also argue that an interest in a set of institutional arrangements in a given context exists where they constitute the route or the means by which different wants and desires may be fulfilled. This is to say that individuals with all kinds of different, even conflicting desires may share an interest in the same set of conventions and practices as long as these allow different individuals to achieve their own objectives. Spickard (1989) points out that Douglas mature thinking is more concerned with the social utility of ideas:

> One encounters precisely the change from an argument based on structural parallels between cosmology and society to one based on the social utility of ideas. Ideas of nature – and of culture, humanity, gardening and so on – are "part of the action" (1982c:200) precisely because they are used for social control. [...] Ideas help maintain social relations. (p. 166)

As part of the action, ideas of nature, and therefore of risk, will be sustained through social interaction as a public good as long as they are the routes towards the fulfilment of different wants and desires. Given this emphasis on social interaction, it is important for Douglas to look at the social environments in which people operate. In her own words (Douglas, 2003), "anthropologists are tougher, and have a less romantic idea of cultural constraints, based on hard economic realities" (p. 1355).

Of course, the linkage between ideas and social organization needs to remain secret if it wants to retain credibility. Fardon (1999), when discussing Douglas' *How Institutions Think* claims:

> Cognitive conventions are granted credibility by their use in pursuit of social interests, thus they become adopted generally. This argument develops the half of her thesis that the disputable legitimacy of institutions is usually grounded in some way or another, with respect to other things that are analogous and less disputable. 'The effort to build strength for fragile social institutions by grounding them in nature is defeated as soon as it is recognised as such. This is why...the hold of the thought style upon the thought world has to be secret'- (HIT 52-53). (p. 231)

Concern for credibility is shared by sociologists of scientific knowledge, who indeed wish to treat and study scientific knowledge as a form of culture as any other and according to whom partiality lowers credibility[23]. The interests associated with one's position within a pattern of social relationships cannot make it to the surface, as at stake there is the credibility of his or her claims. Incidentally, reference to narrow vested interests is a tactic frequently used in controversies by individuals who want to discredit knowledge claims made by the opposing factions. In these cases, the accusers tend to charge opposing beliefs as being ideological. In Barnes (1977) words:

> beliefs are held to be ideologically determined if they are created, accepted or sustained, in the particular form that they have, only because they are related to particular social interests. Such interests are among the causes of the beliefs, or of the form in which they are found;

[23] The work of Thomas Kuhn (1962) has been very influential for this approach. The literature on the role of interests in the production of scientific knowledge is nowadays very large. Classical examples are Shapin (1979), MacKenzie (1981), Shapin and Shaffer (1985), Bloor (1991). Shapin and Shaffer (1985) is an interesting example of how interests have played an important role in the creation of the Royal Society and the establishment of experimental philosophy and how credible testimony was a central problem in this processes. For an alternative, ethnographic approach to the study of science which underplays the role of interests and motivations see Latour (19…) and Latour and Woolgar (1989). On their attitude towards credibility see Latour and Woolgar (1982:43).

> they help to explain why the beliefs have the form that they do have. And since this is so, the beliefs are held to be exposed as inadequate or inadequately grounded. (p. 27)

It is clear, however, from the argument so far, that all knowledge claims derive from social interests, and therefore all beliefs need to be considered as ideologically determined. This has very important methodological implications for sociologists, who need to treat knowledge claims from opposing factions alike.

## *2.7 Grid/Group Applied to the GM Debate*

The previous discussion of Cultural Theory and of interests as the relevant sociological cause of joint social action – and its relation to issues like analogical associations, credibility, ideology and risk definition – leads the discussion to the only attempt known to me to use Cultural Theory (as refined by Schwarz and Thompson (1990)) to explain the GM debate in Britain. I am referring to Levidow's doctoral thesis *Contested Rationality: Early Regulation of GMO releases in Britain* (1994)[24].

*Contested Rationality* analyses and explains the regulatory debate around the intentional release of GMOs in the UK that took place between 1989 and 1992. Levidow agrees with Schwarz and Thompson (S&T) (1990) that the political landscape is populated by different rationalities, or political cultures, "each of which emphasises a different structure of the relevant uncertainty, rooted in a cognitive 'myth of nature'" (Levidow, 1994:8), but he is also aware of the fact that the fourfold scheme offered and used by cultural theorists "may oversimplify the subtle differences and ambivalences which arise in real-life controversies" (p. 8). It is true, he says, that risk regulation can be conceived as "procedural rationality", where the adjective pushes analysts to concern themselves with "the properties of who does what than with trying to evaluate the outcome" (Levidow 1994:8, citing S&T, 1990:7) and "emphasises a legitimation process rather than a scientific basis" (p. 7). Nevertheless,

[24] In this work is clearly visible the future orientation of Levidow's work. See for example Levidow (2002), Levidow and Carr (1997, 2007), Levidow, Carr et al. (1996, 2005).

> In particular, by distinguishing between 'regulatory hierarchies vs entrepreneurial markets', the typology may be too simplistic, for several reasons. First, when risk controversy has challenged the legitimacy of technoscietific 'progress', safety regulation has often served to overcome the threat [...] Second, when national regulatory differences posed trade barriers – to hazardous chemicals, for example – industry has often been willing to accept more stringent regulation and to incur higher regulatory costs, for the sake of promoting free trade [...] Third, safety standards often play the implicit economic role of co-ordinating market relations, while favouring some innovations over others [...] Fourth, environmental regulation may spur innovation by altering market conditions, often as an implicit or explicit rationale for regulatory changes [...] Thus a 'procedural rationality' may complement, incorporate or promote market-innovative forces. (p. 8-9)

Starting from these considerations, Levidow is able to overcome the opposition between safety regulation versus other rationalities. He successfully shows, in my opinion, that GMO regulation saw the conflict between different rationalities, that is "between regulators, industry and environmental groups" (p. 205), and that this conflict arose within the regulatory procedure itself. Levidow thus argues that "the regulatory procedure mediated between internal poles of tensions which various theorists attribute to distinct rationalites" (p. 205).

Despite stating of overcoming some of the limitations of Cultural Theory, Levidow's treatment of the debate is not that dissimilar from S&T's approach to technological controversies, in the sense that the GM regulatory debate is fundamentally described as a conflict between different cognitive frameworks featuring different ideas of nature, or 'myths of nature'. In particular, Levidow emphasises the contrast between industry and environmental groups' views of the potential environmental implications of GMOs. He claims that industry basically adopted a green rhetoric for describing GMOs. In other words, GMOs were presented as environment-friendly thanks to enhanced precision in the modification process, a more targeted use and less reliance on agro-chemicals.

As to the safety assumptions, industrialists accepted molecular biologists' claims that GMOs could not represent a significant environmental hazard, because extensive experience with plant breeding showed that most changes in the genetic make-up made the resulting plants less competitive in the natural environment, and therefore unlikely to survive and become invasive. This argument would suggest the idea that man-made products are in need to be protected from nature, rather than the opposite.

By contrast, environmental groups described GMOs as "potential pollutants running out of control and thus threatening a fragile Nature" (p. 206). According to Levidow, this argument was "partly justified by ecologists' concerns about GMO releases" (p. 77). Indeed, he claims that

> for many ecologists [...] it was premature to classify GMOs by analogy to organisms familiar from past experience. Indeed, some GMOs could prove analogous to non-indigenous organisms which have unexpectedly acquired a relative advantage in their new environment. Ecologists associated genetic novelty with grater unpredictability; some conceptualised 'ecological niches' as dependent upon genetic variation, not simply upon environment. In order to detect potential harm, they proposed extensive field tests, and more basic ecological research, before any GMO could be regarded as innocuous. (p. 5)

The general impression that Levidow gives to his readers is that environmental groups were able to expose industrialists' value-judgements by raising counter-arguments offered by the ecological community[25]. Through these counter-arguments, environmentalists managed to associate the development of agro-biotechnology to obscure, commercially-driven motives that could only aggravate the hazards of intensive industrial agricultural practices.

As a result of this debate, according to the author, industry reluctantly accepted a precautionary legislation, although between 1989 and 1992 there was little direct environmental campaigning on GMOs, and therefore there was

[25] On this disciplinary divide see also Krimsky (1988). See also Barton and Brill (1983), Colwell (1985) and Brill (1986).

little public awareness of the topic. In Levidow's account, regulation took the form of a mediation between environmental concerns and commercial interests. This was the case, he claims, both in the European Directive 90/220 and in the formation of ACRE (advisory Committee for Releases into the Environment) in Britain. As enunciated in an article co-authored with Joyce Tait, Levidow (1993) ended up associating the constitution of ACRE and the definition of GMOs as cosmetic solutions – that is, more as a rhetorical tool rather than a mechanism to control hazards, the definition of which depends upon divergent visions of nature.

There are two major limits in Levidow's analysis. As seen, Levidow describes the framing of GMOs by different social actors as the result of analogical associations with different ranges of previous knowledge. This is the correct way to proceed as all new knowledge depends on existing one. There is however a problem in the way these analogical associations are treated by the author, which relates to what was being discussed in the previous section about ideology. Indeed, by contrasting industry's reference to acceptable practices like beer brewing or plant breeding with environmentalists' use of ecologists' considerations, Levidow conclude that industrialists' knowledge claims are distorted, or at least biased, by their commercial interests. The final result is an implicit prescription to government and regulators to make their value-judgements explicit, and an explicit call for biotechnology critics "to resist the regulatory strategies for marginalising their accounts of the risk problem" (p. 218). This approach is problematic as it treats one set of knowledge claims as ideological, while the other as a legitimate expression of concerns, when they should in fact be treated as ideological as well. This asymmetric treatment, in light of the discussion so far, can hardly be justified, and indeed it is not in Levidow's work. This is the first limitation.

There is however a second problem. Levidow's description is affected by a chronic manifestation of transcendent individualism, as he talks for example about industry or the government as a single organism with little or no differentiation within it. This attitude, unfortunately, tends to obscure how what people say is related to the social environment in which they move and thus fails to properly associate social agents' values, beliefs and actions to the position they occupy within the social structure. There is little concern to show how internal institutional dynamics developed over time, but this is a fundamental step to undertake if we stick to the central idea in Cultural Theory that beliefs and actions, as cultural products, will be evaluated in relation to what they do for the actors using them. This shortcoming may be due to Levidow's fundamental reliance on the S&T's interpretation of Douglas' framework. The following quote by S&T (1990) is an explicit admission of this individualism:

> The strength of cultural theory, however, is that it sets off by treating individuals not as self-sustaining and diverse bundles of preferences but as social beings; people who, in deriving their individuality from their involvement with others, are already connected up into the wider scheme of things. Consequently, it has no difficulty in conceptualizing social organizations in terms of what are, in effect, aggregations of similarly institutionalised individuals. It is this that enables institutionalised policy actors to be classified by reference to the culturally induced personal strategies, perceptions and justifications of the grid/group map.
> [...] Cultural biases, you could say, align potential constituents who, when conditions are right, effortlessly coalesce into institutional policy actors. (p. 71)

This quote seems to unambiguously dismiss Douglas' attention to the social utility of ideas, which presupposed very active social beings, and to provide the image of human beings as cultural puppets that Garfinkel had already rejected (Garfinkel, 1967). However, I find it hard to say something definite about this, as S&T's discussion swings from one vision of the human being to the other in a quite disorienting way. On my part, I can say that the next chapters will show the difficulty of treating policy actors in such an undifferentiated way. Deconstructing what are treated by Levidow as uniform policy actors constitutes an important part of the following analysis of the institutional dynamics characterising the GM debate in the UK and for the reaching a more exhaustive sociological explanation.

Before doing this, however, there is the need to make clear the methodological basis of this work. This is what I will do in the next chapter.

# Chapter 3 – Methodological Framework, Collection and Interpretation of Data

The previous chapters have argued that in order to understand the GM debate it is not useful to treat GMOs as objects with inherent qualities and powers. They should instead be treated as a cultural object, which acquires meaning and power only within a context of social relationships among social agents with different interests and goals. Griswold (1987: 4) defines a cultural object as "shared meaning embodied in form", thus emphasising the relational context in which the object is constituted and in which it acquires relevance. This chapter explains what it means to treat GMOs as a cultural object. Section 3.1 introduces the concept of cultural object and describes its usefulness in the context of this thesis, particularly in the analysis of PROSAMO. Section 3.2 explains in detail how the PROSAMO initiative has been analysed and interpreted as a cultural object. The same section highlights the advantages and limitations of focussing on the Unilever archive of this initiative. Section 3.3 describes how the limitations of the archive have been tackled with interviews of relevant participants in PROSAMO. It also describes in some detail the rationale behind the interview procedure. The style in this chapter is a bit more personal compared to other chapters. This reflects the attempt to describe the methodology adopted not simply as something given and ready to be used, but rather as a constant learning process.

## *3.1 GMO as Cultural Object*

Following Griswold (1987), treating GMOs as a cultural object requires it to be comprehended first and then explained. "*Comprehension* is the analyst's consideration of the internal structures, patterns and symbolic carrying capacities of the cultural object" (p. 5). In other words, "to comprehend a cultural object one begins with the genres, distinctions, and comparisons used by the experts on the object in question" (p. 24). This means that it is necessary to identify the relevant social agents that talk about and deal with GMOs and to consider what they do with them. Levidow's work has facilitated this task with his description of GMO as a social category used by different social groups, but it has been also argued that his consideration of the relevant social agents is problematic. "*Explanation* is the analyst's drawing of connections between comprehended cultural objects and the external social world, connections that are mediated by reception and intention" (Griswold, 1987:5). This is where my thesis can offer the most interesting contribution.

The following questions, then, must be addressed: who uses or used the concept of GMOs? In which context? What do or did they say about it? How do or did they interact with the cultural object? The next question is: what do or did these beliefs do for the people using them within the relational context?

In line with Griswold, the answer to these questions require the analyst to take into account the intentions and expectations of the relevant social agents that constitute the cultural object through interaction. In turn, the identification their intentions and expectations requires reference to the context in which agents operate: the mentality of social categories or groups of people; their social and cultural experience; and the larger social dynamics involved. All these aspects need to be considered because of their impact in determining the agents' choices and actions. This effort necessarily translates into a description of the historical background of the GM research, of the political circumstances of the period under consideration and of the activities and conditions of relevant social agents. With regard to the intentions of social agents, Griswold (1987) says:

> While it is futile to try to get at the subjectivity of any particular individual, it is possible to reconstruct the probable intentionality of any agent whose context and behaviour are known. The purpose of doing so is to separate the individually idiosyncratic from the socially influenced by determining the degree to which intentionality has been shaped by social elements, which may be shared, and the degree to which cultural outcomes are themselves shaped by intentions. (p. 6)

Similar considerations are also relevant when taking into account social agents' expectations. It is also important to consider the expectations surrounding cultural objects as these expectations affect the way the object is received. To anticipate some issues, the hypothesis here is that GMOs became an established category in the way we know it because through its constitution the dominant institutions thought they could achieve certain objectives. When the reception of the concept of GMOs outside the institutional domain became clearly negative, those involved in establishing it in the first place started to reject it. The object that they helped to create basically turned into something different from what they had intended due to the input of different social actors, and the new object did not meet their expectations.

Given that an object makes sense only within a relational context, if our purpose is to explain how it gets constituted and established, the most interesting phenomena to look at are those instances in which all or most of the relevant social agents are involved at the same time, so that they can directly relate to the cultural object they are creating and to each other. While this is not always possible – for example when the cultural object is the creation of an individual artist working alone – when it does happen, the process of definition of the cultural object and the negotiations behind its creation become easier to observe and describe. This is the reason why I have focused on PROSAMO. Although PROSAMO formally started in 1989, it was initially conceived in 1986, well before the GMOs became a popular issue in the public domain. PROSAMO was aimed at determining the environmental impact of the release of genetically modified organisms into the environment through a series of scientific experiments. This initiative is particularly relevant in this study of GMOs as a cultural object because it provides an opportunity to identify the contribution that dominant institutions in the UK gave towards the constitution of GMOs as an established category for understanding reality. PROSAMO is also particularly significant as some of its members have played an important role in the GM debate during the decade following the end of the initiative. It will therefore provide an interesting prequel to many of the studies undertaken of the public debate characterising the 1990s and will help to recast them.

As with GMOs, PROSAMO itself can and will be analysed and interpreted as a cultural object. PROSAMO can also be seen, to a certain extent, as an instance of repudiated offspring. As long as PROSAMO could support the different objectives that the different participants held, it was a cultural object in the sense of being shared meaning embodied in form. Once it could not represent all the different objectives that were motivating its existence, PROSAMO as shared meaning started to decline. It will be interesting to see how the conceptualisation of GMOs changed concomitantly with the progressively changing meanings of PROSAMO, and that these changes were caused by the same set of factors.

## *3.2 Studying PROSAMO*

As mentioned earlier, the study of a cultural object requires the analyst to examine the intentions and expectations of those constituting the object itself. For this reason, treating PROSAMO as a cultural object means considering intentions and expectations of its participants, the understanding of which necessarily involves a detailed description of the historical background and of the wider social environment in which the relevant social agents were moving.

### 3.2.1 The historical background

The understanding of the historical background has been facilitated by prior research. In this thesis, I have already made extensive use of the work of: Susan Wright (1994) – who provided a detailed analysis of the debate over the regulation of the use of genetic engineering in the laboratory; Mark Cantley (1992, 1995) – who for a long time has chaired the Concertation Unit for Biotechnology in Europe (CUBE); and Joyce Tait – who, in various articles, has reconstructed the commercial and innovation strategies of the big multinational companies involved in biotechnology. Among the three, the most problematic author to deal with has probably been Cantley, whose partisanship in favour of GMOs is well known In fact, I have used his work not for its interpretative insight, but rather as a precise and detailed description of the events taking place in Europe in the 1980s. Cantley's account of the GM debate makes extensive use of original documents which provide useful information about these years.

Some may argue that Tait's account of the debate is also biased, as she is clearly in favour of genetic engineering. In a talk at the University of Exeter in

2007 she claimed that the introduction of the precautionary principle undermined the role of evidence in decision making about technology, a statement that finds echo in her contributions (for example Tait, 2001c). Whether she is unduly biased or not is an issue that should not affect the usefulness of her ideas for this thesis, as I am mainly interested with her analysis of companies' attitude and strategic use of the precautionary principle (see Chapter 4 and Chapter 7 for more on the precautionary principle).

### 3.2.2 PROSAMO

The decision to focus on PROSAMO was not taken immediately. When I initially started this PhD, I was more interested in using GMO as a case study in order to understand the communication of science in the UK, as my experience with the Italian context could serve as a useful comparison. My interest in PROSAMO started because one of my colleagues and former senior industrial researcher in plant genomics, Prof. Steve Hughes, got hold – through his former colleague in Unilever Dr Geraldine Schofield – of the Unilever archive of the initiative, to which he contributed in its initial stages. Prof. Hughes and Prof. Barry Barnes were interested in PROSAMO because it could provide a valuable insight into how 'genetic modification' and 'genetically modified organisms' became established categories of discourse and understanding. They thought that I could make good use of some of the materials available in the archive. Indeed one particular document immediately captured my interest and stimulated further thinking. This document was the brochure (Fishlock, 1993) that was published towards the end of 1993 and that was aimed at publicising the PROSAMO results to the wider society. As an attempt to communicate GMOs, the brochure was in line with my focus on communication. But what really intrigued me was the fact that the brochure is not at all in line with the usual accounts of science communication at a popular level, where information tends to be presented in an apodictic, incontrovertible style and where factual information is only marginal and serves as a support for wider discussions (see Shinn and Whitley, 1985). In the brochure, science and scientific information are not only central, but the communicative style is apologetic and vaguely reminiscent of advertising techniques (see Chapter 8 for more on the brochure). It was the surprise caused by the brochure that made me think about the relevance of the institutional interactions. What made important institutional actors to adopt such an unusual form of communication? What made dominant institutions explicitly justify their activity from a moral point of view (see Chapter 8)? Where is the apodictic, incontrovertible style identified by other scholars (Cloitre and Shinn, 1985; see also Green, 1985)?

One may find it difficult to attribute significance to a simple brochure, a single case in a much wider context. However, given the centrality of some of the PROSAMO members in the GM debate in the following years – organisations like Unilever, Imperial Chemical Industry (ICI) or Monsanto – dismissing the brochure as inconsequential would be a terrible mistake. Of course, I did not treat the brochure as a generalising tool, but rather as a manifestation of important social dynamics that deserve more attention than usually granted by other scholars (see Chapter 2). In agreement with Geertz (1973: 448), we may read the brochure not just as a story told to other people, but also "a story they [the institutional actors in this case] tell themselves about themselves". In this sense, the brochure can reveal a lot about society despite its lack of generalising powers. It was this unusual communicative style that, as I mentioned in the introduction, made me look at my undergraduate thesis differently. It stimulated my interest in developing a more accurate understanding of institutional dynamics as a way to interpret the GM debate. I therefore decided to look at the PROSAMO archive more closely.

### 3.2.3 The PROSAMO archive

In order to understand the institutional dynamics involved in the earliest stages of the regulatory debate over the release of GMOs into the environment, the first step to undertake was to look closely at the PROSAMO archive, which consists of fax and letter exchanges, reports of experiments and internal documents, and which was already available and accessible in Egenis. It was not a well organized archive, as documents from various initiatives and from different periods were mixed together without a precise rationale. For example, documents from PROSAMO were mixed with Unilever internal documents from a few years earlier, with documents from the Unilever Biotechnology Working Party (see Chapter 8) set up after the formal beginning of PROSAMO, and with authorization applications to the UK Advisory Committee for Releases into the Environment (ACRE). Although this mixture did not facilitate the analysis of PROSAMO, having access to documents of different nature, from different initiatives in the same time-frame gave me a much wider perspective than I would have obtained by looking only at the documents pertaining to PROSAMO. This enabled me to draw important connections between PROSAMO and the wider context.

The first step was to order the documents chronologically, in order to get an idea of the sequence of events taking place between 1986 and 1993. From this ordering, I was able to divide the PROSAMO experience into three relevant periods: 1986-1989, 1989-1992, 1992-1993.

The first period is the preparation stage, when PROSAMO is conceived (1986) and when the first contacts among future members take place. The significance of this first period in the temporal lag between the conception of the initiative in 1986 and its formal start in 1989. Why did it take such a long time to set up and start the experiments? Were there difficulties? If so, of what kind? Were there technical difficulties or problems in getting to an agreement? This delay is suspicious and as such deserves attention. The second stage is probably the most problematic one. This is the period in which the experiments are undertaken by the university departments that had won the competition for funding. The plant experiments went relatively smoothly, although some problems have been reported in Cornwall (Levidow, 1994:140-142; Martin and Tait, 1992), where in 1991 the researchers faced the opposition from local residents and newspapers. The archive documents make little reference to this episode, probably a sign that the members of PROSAMO did not attribute great significance to it. Indeed, Levidow (1994) reports that “some regulators attributed their Cornwall difficulties to contingent circumstances”:

> In a 1988 accident in which the water supply was accidentally poisoned with aluminium after which the authorities initially denied the mishap and they denied the health damage. (p. 142)

According to one of my interviewees – one of the researchers doing the work in Cornwall – the water accident sensitized the population against GMOs:

> There were interesting problems in Cornwall but it had nothing to do with GMOs. They had to do with a water poisoning incident in a place called Camelford…so the environment agency had dumped aluminium hydroxide I think which is supposed to add to drinking water in minute quantities but they put a whole lorry load in the drinking water system…and the town of Camelford, which is one of the town that was chosen just by chance…many of the people in the town suffered very badly for this polluted water. They had blistered mouth, they were very sick for a long period and some of them blamed long term inability on this …that had raised the temperature of anti-government sentiment in Cornwall to unprecedented levels, which was yet another example they thought of the government trying to use Cornwall as a distant sort of place to do unpleasant things in. There was no sense of the current sort of anti-GM mindset "we don't want to be forced to eat GM foods" that was many many years away down the road.

Researchers and regulators dealt with the public opposition by setting up a series of meetings between residents, local farmers and researchers. The aim of the meetings was to reassure the public. But despite these efforts, it is clear that the people in charge of PROSAMO thought that the problem was too local to be taken very seriously. In a sense, this episode represents an interesting case of a mismanaged relationship between experts and local communities, very much in line with Wynne's framework introduced in Chapter 2. On the other hand, it also reflects the PROSAMO people's awareness that the issue of public perception could not be dealt with appropriately on the basis of such a local and atypical case. Given the widespread negative attitude towards GMOs that ended up embracing even a large number of people whose life was not directly affected by the new technology, the little regard paid by the dominant institutions to the Cornwall episode was not entirely off the mark. The conclusions that can be drawn from this episode, although sociologically interesting, can barely illuminate what was going on in the wider and highly diversified social environment. My guess is that in order to account for so widespread a negative attitude, one needs to analyze what input the dominant institutions gave to the development of the GM debate at a somewhat more general level. I will therefore pay little attention to the Cornwall problem in this work.

The microbial side of PROSAMO was in contrast characterized by major problems from the start. Microbes were perceived to be more problematic than plants because it was difficult to keep track of them in the soil. Therefore, as reported by Levidow (1994: 154), on the microbial side "Prosamo focused upon developing techniques for marking and detecting two representative soil bacteria, *Pseudomonas fluorescens* and *Bacillus subtilis*". Despite detection being the most significant problem for microorganisms, the early archive documents reveal considerable optimism with regard to possible solutions (see Chapter 7). By the participants' own admission, this optimism was misplaced, as the researchers kept struggling to detect micro-organisms in the soil, to the point that some considered the microbial side of PROSAMO a failure. One plant scientist described the microbial research to me in the following terms:

> PROSAMO, to me, was all about…well it's difficult because it was a 2 phase project only half of which was interesting. Half of which was interesting had to do with whether GM alters the ecological behaviour of crop plants and there was another half which was a complete failure about whether you can track GM microbes in the environment. And that part of the PROSAMO project never got a single release of a microbe into the environment. It was a complete waste of time. So that is why I mean it was only half interesting project. Because the microbial half I think was a complete failure. And I guess you are not interested in the microbial half, eh? Because it never didany release…but it's interesting for you to know it was half the money, half the project[26].

A signal of this perceived failure is the absence of any reference to the microbial research in the official description of PROSAMO, as evidenced by the abovementioned brochure. Although a discussion of the technical problems

[26] This quote will be reproduced in Chapter 4. I have considered the repetition necessary to highlight another aspect of the institutional dynamics.

characterizing the experiments is beyond my capabilities, this does not prevent the interpretation ofthe omission of the microbial experiments from public communication in the light of the wider context. Particularly significant is the approval, in 1990, of the European Directive 90/220 on releases of GMOs into the environment. More on microbes can be found in Chapter 5 (5.4). On the Directive 90/220 more will be said in Chapter 7 (7.2).

As will be explored in later chapters, the 90/220 Directive is also relevant in understanding the third period identified, 1992-1993, which coincides with the conclusion of the experiments and the start of the ‘promotional phase’. The most interesting aspect of this phase is the delay between the end of the experiments and the publishing of the brochure, a time lag of at least 15 months. Why did it take such a long time? Did something happen between the end of the experiments and the publication date? Does the apologetic style characterizing the brochure have something to do with this delay? Chapter 8 will provide some interesting answers.

From an analytical point of view, the relative small number of documents allowed a complete, direct reading of the archive. Among the document available, only a few turned out to be essential for achieving an adequate understanding of the social dynamics involved in the early GM debate, and these are those on which the analysis will focus.

### 3.2.4 Advantages and limitations

The archive represented a fundamental resource, as it helped to identify the relevant issues that were arising from the development of rDNA technology applied in agriculture. It allowed me to see who the most important institutional actors and key individual figures operating in the UK and what their concerns were as well as giving me direct access to their own framing of the GM problem and its changes.

Despite its relevance, the archive had two important limitations that needed to be taken into account. First, it did not unveiled the gaps identified in the previous section – why did PROSAMO take such a long time to start? Why did the microbial half of the project disappeared from public communication? What were the causes of the delay in the publication of the brochure? Second, it is the Unilever archive, and for this reason an exclusive focus on its documents could produce a biased account. In order to overcome these limitations, the study of the archive needed to be complemerted with other resources: Tait's work on European multinational agrochemical corporations (see Chapter 4) and direct interviews with some of the key people involved in PROSAMO.

## *3.3 Interviews*

The interviews have been a very useful tool to fill the gaps left by the archive and to spot the bias inherent in Unilever's reports and activities. Hearing other participants' versions helped me to draw comparisons and allowed me to treat PROSAMO as a cultural object, as a set of shared meanings embodied in form. I also hoped to be able to get hold of other PROSAMO documents that the key figures I wanted to interview may have kept. I was not lucky in this, as all of them had disposed o their own archive a long time ago. After all, it is an initiative that took place more than 20 years ago. I do not think this is a significant drawback, however, as the Unilever archive was accurate enough to prepare the interview sessions adequately.

### 3.3.1 Selection of interviewees

The selection of the interviewee was not a particularly difficult task, because just under 20 individuals played a significant role in decision making and planning in PROSAMO. Most of the relevant names were available in the archive, but the main difficulty was to find the updated contact details, given that all of them changed activities or positions or even retired to private life since the PROSAMO experience. The obvious starting point was to interview Steve Hughes (identified as interviewee U1), my Egenis colleague who at the time in question was working for Unilever and had some initial involvement with the initiative[27]. Through Hughes, I was able start the 'snowballing' method

[27] Hughes was the ideal starting point for various reasons. First as a young and inexperienced interviewer, I was a bit intimidated by having to face highly qualified, renowned scientists on their own ground. I felt like those students of Garfinkel who were asked to bargain the price of items in shops: anxious and uncomfortable within this novel role. Hughes represented a good opportunity to practice my interviewing techniques with a familiar person without feeling too threatened. Second, given Hughes limited role in PROSAMO, had the interview process gone

to get in touch with other key participants. U1 put me in contact with another important Unilever representative in PROSAMO (U2). U2 in turn addressed me to some of the other people involved, like an ICI representative (I1), and a Shell Research one (S1), who together with U2 played a key role in PROSAMO. Among the names I have been given by these three informants, there were also Mark Cantley, whom I interviewed as an expert on the European context, and John Beringer, who was the chairman of the ACRE committee. U1, I1 and S1 were the interviewees I chose to represent industrial members. They were the representatives of the most important multinational corporations operating in different sectors: Unilever in the food and consumer products area; ICI and Shell in the chemical business to business field. In addition to I1, I had the chance to interview another representative of ICI (I2), whom I met at an academic seminar in 2007. I could have interviewed also other companies' representatives, for example from Monsanto, and I planned to do so, given the somewhat strange position covered by Monsanto in Europe. The company has been blamed by all my interviewees for giving agricultural biotechnology the negative image it now has. I initially thought that it would have been interesting to hear also Monsanto's perspective. But the problems with Monsanto were not really relevant at the time of PROSAMO, and the initial attitude of Monsanto towards biotechnology had been explored already by Tait (see Chapter 4). I therefore decided that more interviews of industry people were not going to add much to what I had already uncovered.

Considering that PROSAMO was a joint initiative, involving academics and civil servants alongside with industrialists, I needed the interviewees to come from all the social environments that contributed to the definition of the project and of the GM issue in general. For this reason I tried to get in touch with the DTI representatives and the academic researchers who undertook the job. This was a strategic part of my field work, since it gave me the possibility of comparing the different viewpoints, to evaluate their relative weight, and to determine with more precision the reciprocal interactions among social actors and social environments.

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badly wrong, I would have lost data from a relatively unimportant informant. It turned out that that first interview was quite successful and he turned to be a much more valuable informant than I initially expected.

From the civil service I was able to interview a member of the DTI Biotechnology Unit (D1). I also wanted to talk to the programme manager appointed by the DTI, Jonathon Thomas, but all my interviewees had lost contact with him and the internet search did not return any result that was recent enough to lead me to him or to a place where he worked.

On the research side, I was able to interview an important member (A1) of the team that was researching the potential invasiveness of genetically modified crops, and another researcher (A2), who played an important role in the research group that studied the issue of cross-pollination from domestic crop varieties to wild relatives. I was not sure whether to interview the researchers employed to do the microbes experiments or not. In the end I decided against it, as it would have brought me a long way from my original aim of understanding the contribution of dominant institutions to the public debate. I therefore decided to concentrate mainly on those aspects of the PROSAMO initiative that made it into the public sphere. The researchers working on plant releases played, in this sense, a much more relevant role that the microbiologists in Essex and Aberdeen. They were the ones who moved at the interface between science and society.

Beyond the insight offered by these eight interviewees directly involved in PROSAMO, I sought the help from people who were involved in PROSAMO, although in a less direct manner. For this reason, I talked to John Beringer, chairman of ACRE, in order to have a clearer picture of the relationship between PROSAMO to its regulatory environment. I also interviewed a social scientist, who preferred to remain anonymous, who was particularly interested in biotechnology at the time and who gave advice to industry people on social matters. This interviewee shed some light on certain social dynamics, especially within the industrial sector, which the archive documents could not unveil. One last person I managed to talk to was Mark Cantley, from whom I sought to know as much as possible about the European regulatory context. Despite this being an interesting conversation, I did not obtain much more than from reading his account of the debate. This may be a sign of the fact that he had the chance and the time to reflect upon his experience in a consistent manner.

### 3.3.2 Interview procedure

The first problem I encountered when preparing the interviews was how to make the respondents willing to talk to me. Although most of them were retired or semi-retired, given their valuable experience some of them may still have had busy agendas. It turned out to be the case, although not to such an extent as to make the arrangement of a meeting too difficult. I wanted to make them understand that my request of a meeting was not going to waste their time. The introduction letter had therefore to have a professional tone and, in order to establish a sense of confidence, had to contain a common link between myself and the interviewee. This link was always a person that I met or talked to and who suggested to discuss certain issues with the interviewees. When I contacted U2, I mentioned her former colleague Steve Hughes. When I requested a meeting with I1, U2 became the link. I adopted the same method with all the interviewees. The style of the letter was also designed to appear as unthreatening as possible, and this required serious thinking about the choice of the vocabulary. I was aware that the GM debate is a hot issue, in which people had invested time and efforts in order to defend and promote their views. It is a debate characterised by a heavily loaded vocabulary and strong emotional attachments. For this reason, I had to avoid all terms that would have given the impression of my being an advocate of this or that faction in the debate. I therefore made no mention of the “GM debate” of “GMOs” formulas, and actually preferred to use more neutral expressions (some of which were used in the archive documentation), for example “recombinant DNA technology”, “social and institutional dynamics” or “regulatory debate”. This precaution was also necessary in order to avoid influencing respondents’ frames of reference by imposing mine. The following is an example of an email sent to the interviewees, the wording of which tries to deliver a sense of seriousness, professional detachment but also to make the respondent feel absolutely necessary for the success of my work:

Dear Sir/Madame,

I am a PhD student at the ESRC Centre for Genomics in Society, University of Exeter. As a social scientist, I am investigating the historical, social and institutional context in which the regulatory debate on the release of recombinant DNA containing organisms emerged between the late 1980s and the early 1990s.

I am using the PROSAMO research project as a case study that would allow me to identify the social dynamic characterising this debate at an institutional level. Given your involvement in PROSAMO, (Name) (Surname) suggested that your insight would represent a valuable source of information for my work. I was therefore wondering if you were willing to meet me and help me to find the answer to some questions that the archive documents of PROSAMO have been unable to provide. I can be very flexible about where and when we could meet, so you may want to suggest the appropriate date and time. I thank you in advance for you help,

Best wishes,

Mario Moroso
ESRC Centre for Genomics in Society
University of Exeter
Byrne House, St German's Road,
Exeter, EX4 4PJ, UK

Of course, the wording had to change for the interviewees who were not directly involved in PROSAMO, but the strategy employed was basically the same. The responses I received from my interviewees were generally enthusiastic and revealed great desire to talk about the topic. This attitude may indicate that I approached them in an overly cautious manner, but I am actually glad I proceeded in this way, given that two of them felt the need to remain anonymous, a sign that the debate about GMOs can be still a delicate issue.

The interviews took place both in professional environments and private houses. Only on three occasions did I meet the interviewees in public spaces, once in the restaurant of a University, once in the bar area of a railway station and once in a private club. In these cases, the tape recording proved to be more problematic because of background noises which make the voices difficult to understand. Where the word [inaudible] appears in the transcripts it is because of noises that obscured the interviewees' responses. Despite these problems, there was no difficulty in the interpretation of the meaning of the sentences.

The preparation of the interviews was generally undertaken on the basis of the archive material available, especially in considerations of the three defining moments of the initiative identified above. My main interest was in understanding the institutional interactions characterising the PROSAMO experience. I was looking for the answer to the following questions: How was PROSAMO supposed to influence regulation? Why there is such a long gap between the conception of PROSAMO and its formal beginning? Were there problems during the experiments? What were their consequences? How was the relationship between government, industry and academia people? How did this relationship influence the outcome of PROSAMO? What made the communication of PROSAMO so unusual? And why was there such a delay between the end of the experiments and the publication of the brochure? These were the topics that were guiding my conversations with the informants. They were not asked directly, but answers to them were sought thorough indirect questions – questions that were related to what they said and did in the past or during the same conversation. This was done in accordance with a technique called mirroring: the interviewer repeats or rephrase what has been said by the interviewee in order to stimulate him or her to elaborate further on the topics and issues raised by him or herself, so to be able to understand the respondents own priorities (Rogers, 1945). In every case, the terminology used was their own. This was done in the light of what Garfinkel has shown about people's procedures for making sense of the world. Garfinkel (1967) showed that people, through the *documentary method of interpretation*, were able to go to a great lenghts to make a peculiar situation coherent and meaningful and that the sense attributed to every act, including speech acts, does not depend on the nature of the act itself. The context of an interview is not different, as the interviewees make sense of the interviewer's questions in terms of an underlying pattern of interpretation, and the interviewer relates the answers to his questions to his or her own underlying pattern of interpretation. Adapting myself to the respondents' vocabulary allowed me to uncover their own accounting schemes without imposing mine on them – which would have influenced their responses – and thus to make sense of the relationship between social positions, identities and behaviour. Without this careful approach, my conversations would have become either misleading or difficult[28].

Only the opening question was pre-formulated in order to launch the conversation. This question was: can you tell me how PROSAMO got started and how you got involved in it? Note that this question is not completely innocent. It tries to cling on a concrete event (PROSAMO) at a specific time (its beginning). Indeed, I thought that focussing on something specific would have provided support to the interviewees' memory, while proceeding in a chronological manner would have (hopefully) prevented the interviewee from interpreting the most distant events in the light of what happened subsequently, which would have resulted in a distorted narrative. For example, when I interviewed the DTI representative, I started with this standard opening question. In a nutshell, he said that it was a joint initiative between industry and government that was part of the LINK scheme, a governmental funding

[28] A good example of the problems that may emerge comes from my interview to I1, which was the third. I got in touch with him after I talked to U2, whom I interviewed some time earlier. In that previous interview, I used the Unilever documents to formulate some of the questions and got some very interesting answers. U2 talked a lot about the PROSAMO experience giving me the possibility of taking notes and asking only a few questions for clarifications. For example U2 explicitly talked about "influencing regulation" or the public through scientific evidence, which I found very interesting. When I interviewed the I1, remembering what U2 told me I asked him if PROSAMO was aimed at influencing regulation, and he corrected me saying that "influencing" was too strong a word with some negative connotations and explained that PROSAMO was simply aimed at providing evidence to regulators. He attributed my use of the term "influence" to my being foreign, so this did not have a too negative impact on the rest of the interview. The difference in social status between us may have also helped to limit the damage, as my lower position within the social hierarchy was unlikely to represent a threat. Nevertheless I noticed that he started to pay more attention to my words, he corrected me a couple more times, clearly suspected me to be against GMOs and encouraging him to talk freely became quite hard work, especially considering I lack the fluency of a native speaker. It was still a useful interview, from which I retrieved interesting information after reviewing it, but the sense of failure I felt soon after it was over taught me to be more careful next times. Industry, as well as academia or the government, have internally very diversified social environments which allow for different views and experiences of the world by the people belonging to these environments. My mistake in this case was to presume that the word "influence" would have elicited similar responses in people belonging to industry, without paying due attention to the fact that people working in a business to consumer company, for example, may have a different attitude towards (business) relationships than people working in the business to business environment.

scheme aimed at stimulating private investments in risky activities and to facilitate knowledge transfer. This answer was a good opportunity to develop the issue of social relationships. I therefore asked him if he encountered any problems during the setting up of PROSAMO or running the programme, and he mentioned that there are always problems in this kind of initiatives, giving me an overview of what may happen. I then asked him to comment upon claims made by Coleman in 1989 (see Chapter 5) about another LINK project that had some problems and asked him if something similar happened in PROSAMO as well. This apparently helped the interviewee to remember certain dynamics that were initially blurred or confused. Below is a significant section of the interview that illustrates the procedure:

> **Q:** Now, we sort of outlined the sort of background. Now, to go back to PROSAMO, I was wondering if, you know, there were you encountered some problems along the way…with the setting up of the programme or with the running of the programme. If there were any…
>
> **D1:** There are always problems in setting up big things that involve a lot of organisation among participants […] But these were the mundane things that you always get […] I think it’s fair to say that there weren’t any particular problems about PROSAMO that weren’t always evident in these things […]
>
> **Q:** It is interesting that you say that, about the fact that there were similar problems in other projects like PROSAMO. I read a paper from Coleman who worked for the DTI, about a project called the Plant Gene Toolkit…and he was describing it as a lengthy process of negotiations because of needed agreement on confidentiality, intellectual property, project management…I was wondering if there were similar…
>
> **D1:** More serious for the Plant Gene Toolkit than for PROSAMO. What the PGT was about was developing new technology that we might use in making new genetically modified plants. In PROSAMO we weren’t inventing new technology And so the concerns about the intellectual property which made the setting up of the PGT, another one I used to

run, I did that too, that was what made that one harder, because people were concerned, I mean the researchers, they wanted to be sure that that would be owned properly and properly protected and so yes, there was a lengthy discussion about that in the PGT but not in PROSAMO because we weren't developing technology.

**Q:** It may be that there were faster and slower companies because one participant from Unilever remembered that there were some issues about intellectual property that some companies have raised in PROSAMO.

**D1:** I have forgotten that. I mean, the companies that were in the PGT were much the same of those in PROSAMO. And the PGT in fact was first. It happened before. And whether people have got rather blurred memory, overlapping the two, I don't know. But my recollection, and I suppose this holds equally with the guy you talked to from Unilever, is blurred because it's a fairly long time ago and I haven't thought about it for however many years it is. But certainly that is the recollection I have, that we didn't have any intellectual property hurdle. On the microbiology side that might have been so.
[**...**]

**Q:** In projects like the PGT what were the issues about intellectual property. Who was raising those issues? Who were the people concerned?

**D1:** Both the companies and the researchers were concerned. I mean the companies were concerned because they were funding half of this work anyway and therefore they argued they thought they have some rights over intellectual property that emerged. The academics, it was the late 80s, we were talking about the project, awareness of the need to protect intellectual property was much more recent in academics. They were beginning to perceive that, you know, if universities' research institutes have protected their intellectual property appropriately, that they might earn some money form it. They hadn't been very slick about that in earlier years. There was that around. And the…some of the universities, were getting into their employment people who knew more about protecting intellectual property and the steps therefore to take. And they were keen to negotiate an arrangement that suited them so there was some discussion about that in PROSAMO. Which I now remember. I mean, as I think about it things slowly come back, of course.

**Q:** That's interesting. There is another thing, also from the documents from the archive is that, but I wasn't able to expand on this…is that, and some people recollect this, there was some difficulty from the civil service to…it wasn't clear within the civil service where the responsibility to fund PROSAMO was. Is that…does that …

**D1:** It wasn't ever unclear from my point of view. It was me, so I was completely sure about that. I mean, you imply it was a perception in the companies. I am not quite clear how that could have arisen because we were the only branch of the government that were involved in discussion about this. AFRC…maybe it's this, yes, I should say something about this. You know as a research student that research is funded in Britain through the Research Councils and then there was in existence the Agriculture and Food Research Council, it was a sort of previous essence of what is now the BBSRC. And I had difficulty inside the Department inside DTI in persuading those who held the money bags that they ought to spend on PROSAMO. And obviously I had to persuade people that it's a sensible thing and show that I will manage it appropriately. They were wary of it, because I think it was aimed at this regulatory issue and the way I managed to unlock their assent was to get an involvement in PROSAMO form AFRC. When I first went to persuade them they said "no, we shouldn't fund this", I went back and said "look, I have now persuaded AFRC that they will fund a bit of it" and DTI said "oh, ok then". So it was a ruse I used to get the money from DTI. They would spend only if the AFRC was there. AFRC involvement in it was simply to give a bit of money in order that it facilitated the release of much more money form DTI. So I think that might be what the origin was of this

> confusion. I only remember that now in our discussion. It unlocks, sort of, things…

This extract is quite revealing of the effectiveness of this interviewing technique. It might be argued that I was too pushy during the interview, and that I somewhat forced the interviewee to overlap the PGT with PROSAMO. But from what he said, his memories of the PGT were quite solid already, so I suggest that it is unlikely he was mixing the two events up. Had I sensed more uncertainty in his account of the PGT, I would have probably have stopped comparing it with PROSAMO. Of course, I could not control the responses of my interviewees and on few occasions it was difficult to keep the conversation on track. But overall, the strategy used worked well in terms of maintaining informants' willingness to share their experience and keeping them focussed on the subject.

## *3.4 Conclusion*

To conclude, I tried to understand the institutionalisation of GMOs through PROSAMO and treated both of them as cultural objects. An understanding of PROSAMO was achieved through a double triangulation between sources of information. I tried to complement the Unilever archive with the interviews of key participants and by talking to people from different relevant social environments. It was a pity that most of the information available on PROSAMO was limited to a small archive and to a relative small number of people involved. If I had been fortunate enough to have access to a bigger and more accurate archive and to have more people to talk to about PROSAMO, this would probably have made the argument in this thesis stronger. But this was most of what was available for PROSAMO. Reasons for the lack of data include that amount of time that has passed since the initiative and its relative lack of success. The temptation to forget it has thus been stronger, I suggest, than for events that are considered successful. As a consequence, not much remained about PROSAMO and if it was not for this work, what now remains would have probably disappeared in a few years time. Within these limitations, I have tried to produce an unbiased, plausible account of both the nature of PROSAMO and the nature of institutional interactions.

# Chapter 4 – PROSAMO, Industry and Regulation

The first chapter has shown that many pan-European companies, through their confederations, wanted to be regulated and were actually actively seeking to achieve a regulatory framework for the release of GMOs into the environment. It has been anticipated that competitiveness and public perception were perceived to be important problems in the wider European context. This chapter and the next one, through the study of PROSAMO, will expand the discussion and will show in fine detail what the UK's dominant institutions wanted to do about these problems and how PROSAMO would have contributed towards their solution. This chapter in particular will show that PROSAMO is a concrete example of industry's eagerness to participate to regulatory discussions, though strongly connected to the UK context rather than to the European one. Section 4.1 explains that PROSAMO started as a private sector initiative with a regulatory objective in mind. Section 4.2 shows that the objective of regulation was not really to improve the safety of biotechnology. As highlighted in 4.3, the main objectives of regulation were commercial, and PROSAMO was generally seen as a shared instrument that could lead towards a regulatory framework that could help realise a diverse range of objectives. Despite regulation being the main objective, 4.4 shows that PROSAMO could have other beneficial outcomes for the companies involved. Section 4.5 offers a summary and 4.6 a conclusion for the chapter.

## *4.1 The genesis of PROSAMO*

PROSAMO has been known in the public domain as the *Planned Release of Selected and Modified Organisms* research project, which was aimed at determining the environmental impact of the release of organisms modified through recombinant DNA technology. The archive shows that although the project formally started in 1989, it was actually conceived in 1986. Precisely, the idea for this project emerged in the summer of 1986, during an international symposium held in Zurich on safety in biotechnology. Some of its participants thought it failed to properly address the topic. The following report, *Resume of Safety Seminar Proceeding*, from Dr Schofield, describes the context that led to the genesis of PROSAMO:

> Recently, an international Symposium was held in Zurich, with aid from the EEC, to discuss Safety in Biotechnology. It meeting it was understood could address itself to the problems of the use of genetically-manipulated cells in production processes, safety in production, the release both deliberate and accidental of genetically altered organisms and the moral issue involved. There were 12 speakers on various topics, all of whom failed to fully address these questions. Little time was spent discussing 'Safety in Biotechnology'. This was the view of the other participants also (e.g. representatives of the HSE, ICI, Glaxo and University depts), one of whom suggested a meeting of a group of interested people in this country from industries involved in genetic manipulation (ICI). The aim would be to have concerted effort to identify problem areas, to produce practical guidelines on process safety and the release of genetically-manipulated cells, and to be an influence on public and governmental bodies.
> *From appendix 2, Document W8131A/WES/SGH/HR, October 1986*

This first document is basically showing that PROSAMO started as an initiative promoted by the private sector. Given the unsatisfactory outcome of this symposium, Imperial Chemical Industry (ICI) suggested a meeting in which UK industries could agree on a common commitment to identify problematic issues related to genetic modification and to provide a solution to them. This meeting was supposed to set the groundwork for other initiatives that would be aimed at influencing the creation of safety guidelines for work with and the release of genetically engineered organisms and to nurture public support for the new technology. This is really the prelude to PROSAMO. This document is very interesting because it provides important information. First, genetic engineering was an issue for a variety of institutional bodies (quangos, government departments, multinational companies, universities). Second, the companies were concerned with public responses towards the emerging applications of the new technology. Third, it confirms that industry wanted to be actively involved in the production of a regulatory framework. Fourth, the issue under discussion was especially the safety of the release of modified organisms into the environment. One of the PROSAMO participants from Unilever (U2) confirmed these points during the interview:

> **Q:** I know that you, as Unilever representative, have been involved in an initiative called PROSAMO. Can you tell me how it got started and why?
> **A:** Then again, it's going back a long time so I have to dig my memory a bit. I'm probably going back to roundabout 1987. I was at a meeting on safety assessment in Zurich which I can't remember it was summer 1986, summer 87, one of those two. And there was a lot of debate, the debate about genetic modification in terms of releases, because really until around about the mid 80s all the emphasis on risk assessment and safety have been on contained use. [...] In this meeting I met Nigel Poole, and he was then working at ICI, and they had a big research station at Gelate Hill, which became Zeneca Seeds and so on. And we got talking about this issue of releases and microbial releases, plant releases and we met [...] I remember we had quite a lot of discussion about what the first major release might be. [...] And at that meeting I think there were quite a lot of companies around the table and some of us thought well "do we know enough about environmental considerations" I think it was on the basis of all this fuss been made in the United States[29]. We just had a debate among ourselves about "should we have more information to go into the public domain" so that

[29] In 1983 a controversy started in the US over the release of a modified micro-organism that was supposed to prevent plants from frosting. This is what The Associated Press report on October 5th, 1983:

> The threat of a lawsuit and approaching cold weather have forced University of California scientists to postpone the first outdoor test of a bacterium genetically altered to improve plants' resistance to frost.
> The test on potato plants at a field station in the uppermost reaches of northern California would have been the first agricultural experiment with a bio-engineered organism ever conducted outside the laboratory.
> The legal threat came three weeks after environmental groups, headed by activist-author Jeremy Rifkin, filed suit against the National Institutes of Health in federal court in Washington to block outdoor tests until the risks can be determined.
> (Anonymous, 1983)

On April 4th 1984, the experiment was yet to be conducted, as reported by The Associated Press again:

> New bacteria nicknamed "ice-minus" will be sprayed on a California potato patch this summer in a controversial, landmark experiment aimed at protecting world food supplies from frost.

it wasn't a matter of being, you know, altruistic about this. As companies, we thought if we did some research about the safety and risk issues then when we came to actually put things in the ground or you know, microorganisms or plants whatever, there would be a body of information already that we could use. So the thought was "maybe we ought, the major companies should try to look, perhaps we should do something because it's a non-competitive issue on the whole risk area". And that's how it sort of started back in 1986-87.

Thus, through PROSAMO the companies were trying to create a body of information about the safety of releasing GMOs that could be used in the

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> Critics are fighting the project in court because it would involve the world's first release to the environment of a certain type of new life form.
> Jeremy Rifkin, the author of "Algeny" and "Who Should Play God?" and a foe of genetic engineering, fears the bacteria might multiply rapidly and spread through the environment, possibly disrupting the normal creation of frost in the atmosphere and changing, "in a fundamental way, worldwide climate patterns."
> But Steve Lindow, a plant pathologist at the University of California at Berkeley, said his experiment "is incredibly safe, the risks are incredibly small and the benefits (to agriculture) are fairly large, so it seems only prudent to go forward."
> (Siegel, 1984)

McGraw-Hill's Biotechnology Newswatch reported on March 3rd, 1986:

> The EPA approved AGS's application for spraying the bacteria on strawberries on November 14, 1985, but the field experiment in California's Monterey County has been delayed for 45 days, because of a land-use ordinance banning it (Newswatch, Feb. 17, p. 8). Also, genetic-engineering foe Jeremy Rifkin is asking a federal judge for an injunction on the California release, which was expected to be decided Feb. 28.
> (Anonymous, 1986a)

The case for ICE-minus received further attention because of Advanced Genetics Sciences misbehaviour. Chemical Week, on March 5th, 1986, reports:

> A field trial by Advanced Genetics Sciences (AGS) of its so-called "ice minus" bacteria is being investigated to find out whether there was a violation of federal regulations. The Environmental Protection Agency (EPA) is investigating a possible violation by AGS of EPA's 1984 "interim regulations," which forbid deliberate environmental releases of genetically engineered microbial pesticides without prior notice to the government. EPA says that AGS inoculated trees with the modified strain of Pseudomonas syringae in February 1985, nine months before the agency approved the bacteria's experimental use on a strawberry patch in California (CW, Nov. 27, 1985, p. 98). The company says that the organism was not actually released into the environment when it was injected with a syringe into more than 45 trees on the roof of its Oakland, Calif., headquarters. An EPA spokesman says the agency wants to determine whether injection of genetically engineered organisms into trees could have adverse effects. "On this particular product, the agency doesn't have much concern, but we're talking about a principle here," he says. EPA approved AGS's application for spraying strawberries with the bacterial on Nov. 14, 1985, but the field experiment has been delayed for 45 days because of a land-use ordinance banning it.
> (Anonymous, 1986b)

These events were of course all well known in Europe and watched with concern.

regulatory debate. That regulation was a relevant issue is further stressed by Dr Sprott and Dr Hughes in their Unilever draft briefing for Sir Goeffrey Allen, Head of Research and a Director in Unilever. The briefing, entitled "Release of genetically engineered entities into the environment" (*Document W8131A/WES/SGH/HR*) tries to provide an overview of Unilever's activities in relation to rDNA technology, a description of the factors affecting the safety of this technology and an overview of the legislative context worldwide. This document, which can be interpreted as Unilever's preparatory work for PROSAMO, as claimed by my Unilever interviewees, clearly shows industry's desire to actively contribute to the regulatory debate. In the abstract, the two authors claimed:

> We have attempted to enumerate and relate the emerging regulatory, the business and the scientific aspects of the release of rDNA organisms into the environment. We conclude that the emerging regulatory climate is reasonable and workable but that business could help by promoting the study and introduction of more objective quantitative risk assessment procedures than proposed currently. […]

Sprott and Hughes also claimed that there was already extensive experience with the regulation of GMOs in the laboratory, which was considered effective, and that this experience should be used as a basis for the regulation of the release into the environment.

> Risk of escape from the laboratory has been extensively evaluated by regulatory bodies such as GMAG […], and its equivalent body in Holland AHCDR and corresponding codes of practice for all institutions have been drawn up and implemented. […]. This scheme underlies the proposals for risk assessment for other areas such as deliberate release which are currently under discussion and evaluation.
> *Document W8131A/WES/SGH/HR, October 1986, p. 5*

### 4.2 GMOs are safe

Despite this focus on safety, it is important to emphasise that safety was not the real concern of the agents involved in the regulatory debate. The first chapter, when discussing Beringer's claims and looking at the attitude of the scientific community at the European level, has already anticipated this point. My interviews with PROSAMO scientists coming from different institutional backgrounds further confirm that safety was not the real concern. For example, one of the scientists then working for ICI stated:

> I think we were one of the companies which initiated PROSAMO. I think we started it because we were investing money, in part, in GM crops. We were convinced they were safe, but if you actually examined our judgement, we actually didn't have specialty on the ecological side, you know, on the flow of genes in many crop plants. We made a lot of assumptions about safety, and we weren't actually convinced that there was the evidence to support those claims. So we saw, with any new technology you have to prove safety as much as you can and you have to convince the public. So PROSAMO was an attempt, way before the present debate started, to actually get some of the evidence both for plants and for microbes.

The previous quote shows that industrial scientists tended to think that genetic engineering was a fairly safe technology. It also shows that those involved in the development of the new technology were quite aware of the social significance of what they were doing in terms of manipulating crops and they were trying to articulate and meet the social concerns that they thought could arise from the wider society. As another industrial scientists, U2, told me:

> The original idea for that sort of venture [PROSAMO] […] the idea for it came I think when somebody called Nigel Poole, what was ICI in those days […] Nigel Poole and Geraldine Schofield were the…sort of founder movers of it. And they talkabout, actually, having a discussion about expected changes in the nature of crops and that it would be good for them as the representatives of the regulatory affairs of two big

companies to start thinking about how some of the issues that were likely to emerge could be anticipated and to some degree responded to by the industries that were likely to be involved.

S1, recalling that period, said:

> So it [PROSAMO] was totally a research programme aimed at trying to address the problems that people perceived. And I said perceived because we hadn't seen any real evidence of the problems.

And he later claimed:

> We don't think as scientists we should get this gratuitous movement of genes – not the word I'm looking for – genes shouldn't just spread all over the place but we do need some information.

A1, an ecologist, told me:

> We knew what the answer was going to be but I think we had to do the experiments to show that scientists were right.
>
> […]
>
> Without exception the ecological community was pro-GM. Absolutely. They thought that there was a tremendous potential to do good things, all sorts of good things. And it's fantastic how slow the GM debate happened.

And complaining about the bureaucratic nature of the project he said:

> **A:** [the project was very bureaucratic] because they led themselves into this trap which is a government error I think, of treating GM technology as a completely new problematic area of human life.
>
> **Q:** Wasn't it considered as such by scientists?
>
> **A:** No, not at all. I think scientists were very grown up about it. They were saying "of course you can use GM for biological weapons. You could use it for very mischievous purposes indeed. But we are not going to do

> that. What we are trying to do here is essentially benign ecologically, environmentally and potentially very useful". So the scientists couldn't believe the level of bureaucracy, they couldn't believe the effectiveness of the demonisation that happened 10 years later.
>
> […]
>
> We knew, everybody knew what the result would be. There were not significant differences between the conventional and the GM plants and less, there was a cost in carrying the GM in which case the GM would have performed less well. There was absolutely no expectation that the GM would have performed better and that therefore be more invasive or more persistent, more problematic.

The same interviewee then introduced the topic of regulation in relation to the safety of GMOs:

> So the trouble was there was this mismatch between the results of the experiments which all the scientists knew for sure in advance because they understand about genetic changes and fitness changes and what was likely to cause fitness changes, and the regulatory requirements and the opponents' views that any genetic manipulation of that sort was like playing god and playing god is bad and playing god is bound to lead to disasters and the disasters they had in mind was, as far as we thought, was that the plant would become invasive.

And in relation to the 'true' reason behind PROSAMO he claimed:

> We knew regulation was in the pipeline before PROSAMO began. PROSAMO was a response to the inevitability of legislation.

All these quotes leave little doubt about the fact that PROSAMO was initiated with a clear regulatory purpose in mind, and that this purpose had something to do with public perception. The fact that the use and release of genetically modified organisms into the environment were considered safe by the majority of those – including scientists – working with the genetic engineering, should reinforce the idea that "GM" and "GMO" are regulatory concepts rather than natural kinds, and that talking about safety was useful for the regulatory purposes of the companies involved. The questions that need to be answered now are: what were these purposes? Why were the companies so concerned about regulation? What kind of regulation were they looking for? How could PROSAMO help to achieve those purposes? In the first chapter it was anticipated that the issues at stake were the competitiveness of industry and public perception. The next sections will try to explore more precisely how regulation of GMOs is related to the competitiveness of biotech companies, to public perception and how the two issues are related to each other.

### *4.3 The need for regulation*

The data collected from the PROSAMO archive and from the interviews allow to confidently claim that the perceived need to produce a body of information to have an impact on the regulatory process was rooted in the previous experience of the regulation of the contained use of recombinant DNA technology. This regulation began by following a fairly restrictive model only to relax and become more flexible as experience on the use of the technology accumulated. Indeed for some time in the UK, requests for permission to undertake certain experiments with recombinant DNA technology in the laboratory had to be evaluated by GMAG, the supervisory body, on a case by case basis. Only after it was thought that considerable experience had been obtained – and also under competitive pressures from other countries – did the members of the competent authorities agreed to relax the requirements for undertaking genetic engineering experiments.

The UK regulatory environment as regards the release of modified organisms was taking a similar direction, although in 1986 there was not yet a formal requirement to notify the authorities about releases into the environment. The guidelines drawn by the ACGM were almost universally treated as statutory by those working on genetic engineering, as confirmed by John Beringer, whose words were reported in an article from the Guardian, November 3, 1987:

> Professor John Beringer, who chairs the sub-committee on planned genetic release at the Health and Safety Executive, acknowledged

yesterday that scientists have no formal obligation to seek permission before releasing 'designer organisms' into the environment.

> 'It is conceivable that some total idiot would make a release without telling us. But there is only a remote chance that someone would do it and risk ruining his career. [...]'
> (Veitch and Erlichman, 1987)

This is in line with Sprott and Hughes account of the legislative situation in the UK up to 1986:

> Explicit regulations based upon a "Statutory Instrument" only bear upon laboratory experiments. There is a requirement to notify the HSE and to demonstrate, upon inspection, that the general provisions of the Health and Safety at Work Act, 1974, have been correctly implemented to protect the employees by measures which would include protection against the release of recombinant organisms.
>
> There are to date no specific statutory requirements to notify the enforcing authorities about the release of genetically manipulated organisms other than pests and biological control agents. However, in addition to the age old provisions of Common Law there are guide lines drawn up by ACGM in collaboration with DoE, MAFF and DHSS for "The Planned Release of Genetically Manipulated Organisms for Agriculture and Environmental Purposes". These anticipate considerable benefits to agriculture and the environment "over the coming decades" but at the same time concede, that owing to the complexity of the environmental interactions, it is not yet possible to devise "a broadly applicable risk assessment scheme". Accordingly, it is concluded, that proposals for the release of genetically manipulated organisms <u>must</u> be considered by ACGM on a case by case basis. From our point of view this amounts to a statutory requirement for notification, and at Unilever we are working within this system. We anticipate that future developments will be influenced by the development of regulatory strategies by the EEC and OECD working parties.

The companies involved in PROSAMO clearly thought that providing the necessary experience before formal requirements were established would contribute to the creation of a more flexible and agile legislative system at a European level. Indeed, the fears were that a strict case-by-case approach would have slowed down the monitoring activity of the supervisory agencies to unacceptable levels. Sprott and Hughes stated:

> We are concerned that case by case review will overburden the supervisory/regulatory bodies. We are also concerned that considerations of commercial secrecy will inhibit the emergence of a case law. For this reason we recommend the development of a formalised risk assessment procedure for use in house by the applicant in order to streamline the subsequent consideration of his application by the regulatory body. (p.18)

My interview with a Unilever participant confirms these fears. The interviewee clarifies industrialists' concerns:

> […] you could see that we didn't have a regulation as such. Everything was very – in 1986, the debate only just started in the EU on regulation of releases into the environment but everybody knew it was coming, and we thought this thing [risk assessment] and this particular project [PROSAMO], if we could focus them correctly could actually be used in those discussions and in risk based decisions.

And also:

> The idea was this had to be a reasonably complete piece of work, it had to be fairly focused and it would actually feed, we all thought it would probably end up feeding into the regulatory system. So that the information could then be used by the people who were going to regulate what you could actually put into the ground and what crop you could actually put out there.

Furthermore, in relation to European regulation, U2 claimed:

> […] within Europe there were certain countries like the UK which wanted a risk-based system and other countries which wanted a regulatory system where it's very much eyes and teach – you'll do this, you will not do that – whereas in the UK through its history of health and safety area, wanted it very much risk-based, so you set up a very broad brush telling you how to do the risk assessment and you come to your own conclusions – you don't go "you can do this you can't do that".

PROSAMO was therefore conceived and perceived as a persuading mechanism that had to convince less experienced European countries about the fact that GMOs were safe and that for this reason a fast regulatory mechanism was appropriate. These concerns were reiterated many times during the interview, revealing how relevant the contained use experience had been in forming industry's position.

One of the reasons is if we didn't have the information that said what the risks were, then if it's like my own area on the contained use, you actually come up with very strict regulations which you gradually sort of loosen up a little with knowledge, so I think there was a concern that if we didn't have information, there would be a very strict regime, regulatory regime.

It was therefore hoped that PROSAMO could provide the necessary scientific knowledge that would confirm scientists' expectations and that would allow the development of a quicker risk assessment procedure by allowing the applicants to do their own risk assessment.

The risk of a too slow regulatory approach was really a concern among European companies, not just in the UK. This is not surprising, given that most of the companies involved in PROSAMO, although based in the UK, were really pan-European companies operating in different national contexts. There was a widespread concern in Europe based companies that a slow regulatory mechanism emerging from common European legislation would hamper their competitive position and scientific leadership in the global market in this fast developing scientific and technological area of inquiry. As seen also in Chapter 1, ECRAB explicitly expressed worries about competitiveness:

> The document [ECRAB position paper] is based on the concept that any guidelines or rules for industrial applications of biotechnology should recognise the benefits offered to our society, while limiting the risks involved. In addition, they should maintain the competitive position of European biotechnology industry vis-a`-vis their competitors on USA and Japan.
> In view of the rapid scientific and technical developments in various fields of industrial biotechnology a consensus on the general guidelines and rules which should apply is urgently needed. (p. 1)

Particularly in the United States, it was clear that the regulatory agencies did not consider the introduction of genetically modified organisms particularly problematic and were unlikely to represent a significant political impediment to the development and applications of the technology after in 1983 they permission to release the Ice- bacteria Pseudomonas on a strawberry field[30]. It was also already quite clear from the 1987 National Academy of Sciences policy statement on releases of GMOs, that there was a sort of 'philosophical' consensus that "the risks associated with the introduction of rDNA-engineered organisms are the same kind as those associated with the introduction into the environment of unmodified organisms and organisms modified by other genetic techniques" (p.6) and that "assessment of the risks of introducing rDNA-engineered organisms into the environment should be based on the nature of the organism and the environment into which it is intended, not on the method by which it is modified" (p.7)[31]. In other words, in the US biotechnology was considered an extension and refinement of already established techniques to produce already regulated products, and products made from genetic engineering would have been regulated under existing sector legislation,

[30] See previous footnote.
[31] For more on the debate on releases in the US see National Academy of Sciences, Committee on the Introduction of Genetically Engineered Organisms into the Environment, *Introduction of Recombinant DNA-Engineered Organisms into the Environment: Key Issues* (1987); National Academy of Sciences, Committee on Scientific Evaluation of the Introduction of Genetically Modified Microorganisms and Plants into the Environment, *Field Testing Genetically Modified Organisms: Framework for Decisions* (1989); Tiedje et al. (1989).

according to the principle of substantial equivalence (on the developmentof US legislation see Levidow (1994)).

### 4.3.1 Public Perception and Regulation

The approach in the US was creating some discomfort in Europe for another reason. European companies were worried that the US regulatory trajectory would have a negative impact on the overall debate on the new technology. In other words, European companies were worried about the negative impact of the US orientation in the European public perception of this new technology. In this regards, Hughes and Sprott say:

> In the US much attention has focused on attempts to field test the so called ice-bacteria. These modified bacteria contain no foreign rDNA and are not readily significantly different from naturally occurring strains which have lost the ice gene. A live pseudorabies vaccine derived via rDNA technology has apparently been approved for release by the USDA without full consultation with all the regulatory bodies. These false starts in the US will do little to support a rational approach to risk assessment in relation to environmental release.
> (p. 11)

It is not difficult to understand why the US approach was worrisome to a company like Unilever. Genetic engineering could be extensively exploited in the wide portfolio of products it sold to the public. But as a consumer based company, Unilever was aware of the need to convince its public of the safety of the products made through biotechnology. This is particularly important in a highly saturated market where the social costs of not buying GMOs because of cheap, more traditional alternatives are very low. In other words, it is very easy to turn against GMOs if this does not compromise one’s lifestyle.

Besides, getting regulation right in the food sector was important especially considering the attention that the authorisation of the use of the bovine growth hormone was receiving in Europe. Thus a company like Unilever, which was approaching biotechnology as a business opportunity in the 1980s understood that an unfavourable public might play an important role in affecting regulation on the release of genetically modified organisms.

This concern about public perception was shared also by the agrochemical companies involved in genetic engineering, though for other reasons. They understood the potential benefits and threats of the new technology for their business and were therefore moving towards a GM trajectory. For these firms, the awareness of the importance of public perception was rooted in the perceived failure, from a public relations point of view, of the regulation aimed at controlling pesticide use. As Tait (2001c) recalls, the agrochemical industry in the 1980s came out from the regulatory process of pesticide with a very low credibility and its public image destroyed. They thought that a different regulatory approach would make GM products more acceptable and the regulation less restrictive.

At this point it is important to distinguish between different approaches to regulation. Pesticide regulation was very much a reactive kind of regulation (Tait and Levidow, 1992). That is to say:

> The industry concerned, and its products, are controlled by a system set up in response to scientifically proven adverse impacts that have arisen in earlier generations of products. New products and processes are screened to ensure that they do not give rise to any similar hazards. The regulatory system is built up slowly, in a piecemeal fashion, as new generations of product or process exhibit different hazards. Decisions about the need for regulation and the level of regulation required are taken in relation to the relevant benefits and costs. (p.221)

It is clear that this kind of approach is not able to prevent pollution or health problems. Instead, it can deal with it only after certain problems have arisen and been scientifically proven. The need was thus felt for a regulatory approach that could anticipate possible hazards (environmental in our case study) and act in order to prevent them even without the prior support of scientific evidence of harm. This proactive approach is described by Tait and Levidow in the following way:

> The industry concerned, and its products, are controlled by a system set up to avoid potential hazards, predicted in advance of the development and/or marketing of products, and before there is any empirical evidence for the existence of such hazards. In such a situation, safety issues and the formulation of the regulatory system become an integral part of the development of the industry itself, as well as its product. (p. 222)

Therefore, with the pesticide experience fresh in industry memories, companies were willing to collaborate with scientists and regulators within a precautionary – as the proactive model was named – principle. The concept of "precautionary principle" ended up meaning many different things for different social actors using it (see Chapter 7.4.1), and it is not my objective to summarise the many different views here. It will be enough to emphasise that, at the time, talking about a precautionary approach was mainly equivalent to the case by case review which had characterised for some time the laboratory use of recombinant DNA technology. But this case by case review had to be a temporary measure and was supposed to be inserted within a larger step-by-step framework. In other words, the precautionary approach was seen as a good compromise between different needs. Companies were willing to embrace it until more information was available about the safety of releasing GMOs into the environment – information that would have formalised the consensus already existing within the scientific community.

It is thus possible to understand, at this point, that a case by case review of the experiments and releases was not considered a bad thing as such. It was actually considered essential as an instrument to reassure the public as long as there was not a risk-based assessment scheme available supported by the authority of science and that allowed a quick quantification of the hazards of releasing GMOs into the environment. Again, Hughes and Sprott clarify this point:

> The approach based on a case by case evaluation by experts at present adopted is all very well as a stop gap for final clearance of difficult cases. However, we can expect the pressure on the regulatory bodies to

> become intolerable. Case law may not become available owing to proprietary implications. Under these circumstances a standardised risk assessment system based on a check list with benchmarks will be necessary. This will enable the applicant to perform his own preclearence exercise and shorten the subsequent review period with the regulatory agency. (p. 10)

It was believed that PROSAMO could provide the authoritative scientific information required to ease public anxieties and to set up a standardised risk assessment system. The following quote from I2 can help to clarify the relationship between PROSAMO and the need for information for regulation:

> […] throughout all of the discussion about the regulatory framework for genetically modified plants there was…because ICI was coming from a chemical industry background it was highly regulated…it always worked in a highly regulated environment so in that sense there was a recognition that you have to work on a regulatory framework and that for this sort of science – then some elements of that regulatory framework compared to, say, chemicals and the regulation of agrochemicals or regulation of pharmaceuticals there were some bits that weren't there, so there was the desire to push the knowledge base to have some data for some obvious questions […] so it was quite in keeping the sort of ethos of the company in the sense that we not only have to comply but we actually have to participate in the development of some understanding about what is the right question to ask if you like.

The quote shows a few interesting things. First, PROSAMO was clearly aimed at producing knowledge that had to be used for regulatory purposes. Traditionally, pesticide regulation followed a reactive model, in the sense that they were regulated on the basis of knowledge collected during and after their use. I2 stresses the absence of a similar knowledge base – which regulators were using to control pesticides – in the case of the release of GMOs into the environment. PROSAMO was meant to fill this knowledge gap and to allow the development of a formal risk assessment system that could be comparable to the pesticide experience, while continue to operate within a precautionary, pro-active frame.

The previous quote also leads towards another issue that concerns the relationship between industry and regulation. Indeed, the interviewee's words highlight how important regulation was for the agrochemical industry, which is an industry that have grown used to be highly regulated and for which the absence of regulation is more likely to represent a competitive disadvantage than an advantage. Actually, most of the companies who got involved in PROSAMO were large bureaucratic organisations which were used to operate in highly regulated markets. Not only their everyday activity had to adjust to regulations, but they saw themselves as legitimate contributors to the development of regulation. The reason for this active attitude is that regulation played an important role in the life of the private sector, even more so for pesticide companies, as the next session will explain.

### 4.3.2 Regulation and Innovation

When exploring the connection between regulation and business, one should consider the role that regulation plays in stimulating innovation[32]. This is particularly relevant for the agrochemical companies, which were among the main players in the development of biotechnology.

There are two main characteristics of the agrochemical business. First, the creation of new products is tied to very strong regulation, to the availability of a highly qualified workforce and to long term development studies. All these aspects combined require very high investments in order to create a new product. In this context, the patents on the products provide the compensation for the high costs the companies have incurred. The agrochemical sector is also highly competitive and mature. Most companies tend to manage the existing range of products in a way that those products which have outlived the patent protection period "or are due for regulatory review" are dropped. In this context, new technologies are sought in order to speed up the process of creation of new products and to increase the efficiency of existing ones. According to Tait (2001a), "biotechnology in the form of functional genomics

[32] Besides the sources cited in this section, read also Chataway and Tait (1993) on the relationship between regulation and innovation in biotechnology.

and proteomics is applied to identify potential new pesticidal active ingredients, often based on natural products” (p. 66N). Tait also describes the agrochemical industry’s market as saturated, meaning that a new product can survive only if it can ‘steal’ market shares from existing products. The problem is that these latter products can be very cheap if the patent protection has expired. Therefore, it may well be much more difficult for a new pesticide to overcome existing ones despite it being more efficient and having a better risk profile. For this reason, Tait (2001b) argues then that “substitution of inferior products by better ones is unlikely to happen without some policy or regulatory assistance” (p.11).

There seems therefore to be a strong relationship between competitive forces and regulation, and it is not unusual that regulation ends up representing an opportunity to create competitive advantage For example, by restricting or banning older and not ‘environmentally friendly’ products, regulation can open markets for new products that are protected by patents and are therefore more profitable. Actually, companies keep monitoring the regulatory environment in order to identify short and long term trends and anticipate certain scenarios that could place particular pressures to the development of new products. In other words, “pesticide regulatory systems are thus an important part of strategic planning for new product development in multinational companies but they are a predictable, routine component that has been incorporated into industry’s standard operating procedures” (p. 13).

### 4.3.3 Predictability

It is worthwhile to focus on the concept of predictability. Regulation is frequently associated with standard procedures that tend to make part of the costs of development of new products clear or at least predictable. The cost figures can then be considered in conjunction with a wider analysis of the business environment, its opportunities and threats, which include the consideration of buyers, new entrants, suppliers and the availability of close substitutes. There is however a problem when the regulatory system does not provide the predictability required for business planning. It is in this context that the hostility towards a prolonged application of a case-by-case approach needs to be understood. The consequence of a case-by-case approach is that each application for a release into the environment is reviewed in its own right and is characterised by intrinsic uncertainties. At any moment of the review process there can be delays, or questions can be raised exactly because each application is fundamentally different from the previous ones. It is true that the competent authorities take into account past experience in the case of similar applications. Nevertheless, this similarity takes its time to be assessed, acknowledged and institutionalised. A case-by-case approach therefore translates into an inherently slow process with uncertain outcomes. And as Tait argues "agro-biotechnology multinational companies can adjust their R&D pipelines to cope with risk regulation so long as its requirements are reasonably predictable" (p. 14). This is the reason why Hughes and Sprott insistently refer to the role that industry could play in providing information that could be supportive of a case law approach:

> This may be an area in which Unilever could, in concert with other companies take an initiative in recommending that a study be undertaken to establish a standardised numerical risk assessment scheme, particularly in relation to accidental release from industrial plant.
>
> […]
>
> Unilever could helpfully influence the practical merit of emerging regulations by encouraging that the present heterogeneous collection of rules and guidelines be superseded by a single[ hopefully international] coherent and rational set of regulation embodying a quantitative risk assessment approach. (p. 10)

PROSAMO was therefore instrumental to the achievement of more predictability useful to business activities.

But the business planning does not only need to take into account how long it will take to develop a product. One of the companies' major concerns is also the possibility to determine how they are going to respond if something wrong happens while or after they do what they do. In other words, companies need to be able to predict the extent of their responsibility. Without regulation, industry would not be able to take into account the costs associated with product and environmental liability and would not be able to shield itself behind legally defined standards and practices[33]. The following extract from my interview with John Beringer, chairman of ACRE during its first years, further strengthen the points made in the last two paragraphs:

> **Beringer**: Industry big worry about legislation was that it was seen to be fair. Most of the industrial people wanted legislation in place. So they knew their discreet. Because industry can work with legislation, it cannot work to ambiguity. There may be some niggling about what was going on but the root is that industry must have strong legislation so they know how to work - they can do their long term planning. Changing policy is a nightmare for industry, and that is maybe why you could get the impression industry doesn't like regulation and legislation because it's changing it that cause them problem.
> […]
> **Question**: Many industrial players came from the pesticide sector. I was wondering if the experience with the regulation of pesticides influenced their attitude towards…
> **B**: Absolutely. Because pesticide regulation got to be very tight so you know exactly what to produce and then go ahead to do it safely without expecting a legal attack.
> **Q**: So, a very tight regulation represented an advantage for industry…
> **B**: A very clear regulation, yes.
> **Q**: Ah. So a clear regulation, not a tight regulation.
> **B**: Well, tight can be interpreted in many different ways. Clear is critical. It is clarity (for) anything you are asked to do you can deliver *(unclear sentence do to poor audio quality)*. As long as clarity is not enormously complicated.

[33] For an example on how product liability is considered by drug companies see Manning (1997). See also Yandle (1974), Morrow (1994) and Sontag (1994).

### 4.3.4 Competition, Product Substitution and Market Lead

Beringer's words do more than just confirm the role of a clear regulation for industry. Given Beringer's experience in ACRE, in which representatives from companies involved in PROSAMO such as Unilever and ICI sat, I think that the interchangeable use of the words 'tight' and 'clear' is a bit more than a coincidence. There are indeed other ways in which regulation can help big corporations, as explained in some depth in the next paragraphs.

First of all, genetic engineering could represent, from a business point of view, a dangerous development for some of the companies involved, particularly chemical ones. Indeed, as pointed out by Tait (2001c), "the development of the first generation of GM crops concentrated on 'input traits', herbicide, insect pest and disease resistance" (p. 12-13), representing in this respect a threat to established markets of chemicals, particularly pesticides. There was, in other words, the potential for technology substitution, which could have been really dramatic for a company with a well defined position within the agrochemical business.

A good example of how diverse industrial interests characterised different attitudes towards biotechnology/genetic engineering is provided by Tait and Chataway (2007). They show how, between the 1980s and the 1990s, European agro-chemical companies were very cautious about promoting GM technology because this would have had a negative impact on their established (pesticide) business. On the other hand, Monsanto employed a very aggressive and vision driven strategy that was extremely supportive of biotechnology. Tait and Chataway argue that Monsanto's attitude is justified by the lack of "antagonism between its pesticide and GM product portfolios" (p. 27). Indeed, Monsanto's pesticide product was the herbicide glyphosate, and the development of herbicide resistant crops would have promoted the use of its chemical. In other words, Monsanto's business was not threatened by the product substitution potential that was concerning other companies.

> An agrochemical company with its main source of income arising from pesticides would have had difficulty in promoting GM crops in the early

> stages of agro-biotechnology development on the basis of a reduction in farmers' reliance on pesticides: this would have undermined companies' long-standing insistence that pesticides which have been approved by the regulatory process are safe when used as recommended. It would also have been problematic to make the case for speculative spending on new technology which would undermine the company's existing product range. (p.27)

Hence, big European agrochemical companies were much more interested in a regulatory environment that by being fairly restrictive, at least at the beginning, could slow the development of the technology and allow them to buy some time with respect to other companies like Monsanto, which were not subject to the same risk of technology substitution and were therefore pushing towards a wide application of recombinant DNA technology, so that they could develop favourable business strategies.

The risk of technology substitution could also potentially come from small companies. A loose regulatory framework, in fact, would have favoured the creation of competition from smaller companies, because the relatively low costs of containment and surveillance required did not pose an insuperable entry barrier into the business. A tight regulation instead, possibly characterised by hierarchical levels of containment, implies much higher costs that cannot be met without considerable financial capabilities. This is certainly not a new way of looking at the development of the regulation of the release of GMOs. Tait and Levidow (1992) acknowledged that regulation could be a useful tool for big agrochemical companies to pursue their economic interests. This is because more regulation translates into higher costs which allow for less competition in terms of new entrants. Less competition, in turn, has the consequence of reducing the pressure towards technology substitution and provides some more time for exploring possible and non obvious synergies between the old and the new businesses.

After the considerations above, it is not difficult to see that PROSAMO was used as a tool to affect regulation in two senses. As a scientific exercise, it could justify a cautious, restrictive regulatory regime that (i) would have allowed the companies involved to buy some time against other companies which were not subject to the same risk of technology substitution and (ii) would have raised the regulatory barriers so as to bar smaller companies from entering the market – at least in the early stages of development when a company usually develops its technological competitive advantage. Besides, these smaller companies were more likely to create problems of public perception. These were indeed expected to have short term goals and to be prone to obtain quick results, even at the expense of safety, in order to appeal to larger companies by which they might be bought. Once these competitiveness problems would be solved, as a complete piece of science PROSAMO could then be used to credibly push for the relaxation of controls.

A similar logic held for Unilever as well, although some distinctions are necessary. It is interesting what the social scientist I interviewed told me:

> There was enormous opposition from companies like Unilever, Nestle and so on to this GM crop trajectory. So you have two big powerful multinational groups jockeying it out for position in the background. Which didn't really come to public light at all, but there was huge confrontation going on there.

This quote basically shows that Unilever was worried about the changes that were going on in the food supply. One needs to remember that agrochemical companies started to buy plant breeding companies towards the middle of the '70s and that this process continued during the 1980s. As Walsh and Lodorfos (2002) report:

> Some firms with capabilities in agrochemicals enhanced them by buying seed companies and developing skills in plant breeding, […]. This was particularly true of Sandoz, which bought Rogers Seeds in 1975, Northrup King in 1976 and Zaadunic Group in 1980. Ciba bought Funk Seeds International in 1974 and ICI began making similar moves from 1985, with its purchase of Garst Seeds. The European chemical firms purchasing US seed firms were also strengthening their position in the

US market. Monsanto acquired DeKalb's wheat programme in 1981 and Jacob Hartz Seeds in 1983. (p. 279)

It is easy to understand why companies like Unilever or Nestle were looking at these changes in the food supply chain unfavourably, as they represented a shi in the power structure of the food industry. Indeed, as claimed by Tait, Chataway and Wield (2000) "traditionally, the marketing horizon of agrochemical companies stopped at the farm" (p. 2) but the managers of multinational agrochemical firms "were looking for a new research and development trajectory that would enable them to avoid becoming mere producers of commodity chemicals, and biotechnology was seen to provide the solution to this problem. [...] This brought agrochemical companies into closer contact with seed companies and also with food-related industries" (p. 2)[34].

It is likely that end-consumer oriented producers, like Unilever is, anticipated the possibility for chemical companies to enter into competition with them with innovative products from biotechnology and thus felt the need to be prepared because, as explained by Dr Schofield in front of the House of Lords Science and Technology Committee – which was conducting an enquiry on the effects of GMOs regulation on UK competitiveness in 1992 – in the end-consumer business the most important thing "is getting a product on the market place. If you are the first you get a product on to the market place. With even a six-month lead time you will take a market lead. If you are delayed for some reason, you are tied up in bureaucracy, you are the second in the marketplace and then you are never likely to have the same impact on the market with the product" (p. 142, from the House of Lords *Minutes of Evidence*, 1993)

It is not surprising that Unilever decided to enter directly into the seed business with its acquisition in 1987 of the PBI breeding programmes and farm site. It was a move that enabled Unilever to closely monitor and be involved in the new biotechnology trajectory. PROSAMO was in line with this objective. It did not only serve as a way to reassure the public. Treating GMOs as deserving

[34] On companies' R&D strategies in agricultural biotechnology see also Chataway, Tait and Wield (2003).

special attention, through initiatives like PROSAMO, was useful to slow things down in order to better monitor the strategies of the other companies.

It is in this context that one needs to interpret Hughes and Sprott explicit support for the formal risk assessment scheme proposed by ECRAB (European Committee on Regulation Aspects of Biotechnology) – a scheme based on the OECD recommendations and that "is composed of five tiers and has a strong empirical element" (p. 10) – made familiar by Chapter 1. ECRAB encouraged risk assessment experiments and a case by case review in the field release area. It is easier now to understand that this scheme was in the interest of both chemical and food companies, even though they had very different objectives.

It is legitimate at this point to wonder what the reasons for Monsanto's involvement in PROSAMO were. Although I have not established direct contact with Monsanto participants, the background information available helps to make a reasonable interpretation. It is well known that Monsanto was one of the companies developing a genetically engineered version of the bovine growth hormone at the beginning of the 1980s. As reported by The Economist, on January 30th 1982, "Genentech (in conjunction with Monsanto) and Biogen (in conjunction with American steroid-producer International Minerals) are working on getting bugs to produce bovine growth hormone. The advantage of the hormone is that, unlike the steroids, it is readily eliminated by the animals' bodies. Recombinant bovine growth hormones are probably still some six years away from the market, however" (Anonymous, 1988). The introduction of the use of growth hormones for agriculture in Europe did not succeed. As reported by The Times (Thomas, 1988), on December 30th 1988, "the decision by the EEC Council to ban all growth-promoting hormones was taken in 1985 after extreme pressure from the European Consumers' Association and the European Parliament". The same article shows how still in 1987 there was a heated debate going on:

> After public hearings in the late 1987 organized by the Rainbow group of the European Parliament, which brings together Europe's Green parties, MEPs stated: 'After in tense and controversial debate, we concluded that genetically-engineered hormones, such as **bovine growth hormone**

(BGH), are the harbinger of an undesirable genetic transformation of agriculture'.

It is clear that given this position of consumer organizations and of green groups towards one of the first product of genetic engineering, Monsanto did not want to see its glyphosate resistant products – which were already in the pipeline in 1986[35] – to have the same welcome, and was thus willing to temporarily move in line with other companies. PROSAMO, despite reducing its competitive advantage against other chemical companies, was probably seen as a vital instrument to win over public scepticism, and it thus represented Monsanto's most cautious phase in the history of its public relations.

## *4.4 Beyond regulation: Feasible Technological Options*

There is another element related to uncertainty that needs to be dealt with. According to Tait (2001b):

> Substitution of one technology by another can be an expensive and uncertain process. The companies that took the early decisions to make major investments in GM technology faced high level of uncertainty about: which technological option would be feasible and on what time scale; whether the technology would work on a farm scale as indicated in early trials; whether products would fit with existing farming systems; whether GM crops would be patentable and thus whether the company would be able to retain exclusive rights to a product for long enough to ensure a profit on the investment. (p. 16)

This uncertainty is one of the most interesting aspects that characterise PROSAMO, and is made visible by the actual lack of a clear idea about what the implications of the release of GMOs into the environment would be. This uncertainty has already been noted in Chapter 1, when the 1986 RECP letter, which was trying to define genetic engineering, was introduced. But it can also be identified in the very organisation of PROSAMO in two distinct research projects. Part of the money was indeed spent to look at gene transfer and cross

[35] See Haney (1986).

pollination in plants, while the other part was spent to identify, or to learn to identify, gene transfer in microbes. It was not clear at all at the time which of the two or if both would have been relevant in terms of regulation for industrial purposes. Actually, U2, while talking about how PROSAMO got started, explicitly said that micro-organisms rather than plants were thought to be more relevant:

> [...]. And we got talking about this issue of releases and microbial releases, plant releases and we met [...] I remember we had quite a lot of discussion about what the first major release might be. At that point there was a lot of feeling it would be micro-organisms rather than plants. And at that meeting I think there were quite a lot of companies around the table and some of us though well "do we know enough about environmental considerations" I think it was on the basis of all this fuss being made in the United States. We just had a debate among ourselves about "should we have more information to go into the public domain" [...]

And referring to PROSAMO with hindsight, the same interviewee claims:

> I guess with hindsight, we probably should have put it all into plants. But because there had been releases of microorganisms, and at the time we thought there were going to be more. Just shows we weren't right, we weren't right about that. But I think we were all a bit seduced by the ICE minus story in the United States, with the release of Psudomonas. I think that probably moved some of our thinking a little bit. But with hindsight we probably should have put more into the plant programme, because again you had to focus it really.

That micro-organisms were considered a promising area was confirmed a few times by I1:

> And so PROSAMO was an attempt way before all the present debate started to actually get some of that evidence both for plants and for microbes. Because in those days we though microbes could be very useful as well.
>
> [...]

> I mean, we made some mistakes. With hindsight, I don't think we needed to have funded the microbiology package, because science didn't develop that way.
>
> […]
>
> In those days there was a lot of excitement about bio-remediation. Using microbes, genetically modified microbes to clean the environment. To improve soil fertility, to break down nasty compounds. So it was a quite active area of research in those days. But it never really developed. Remember, we were ahead of the industrial process. So we were way ahead of commercialisation. So one didn't know were commercialisation was going to develop.

Others scientists I interviewed had less than positive words about the microbial programme. A1, when asked to describe the aims of PROSAMO, was quite revealing:

> PROSAMO, to me, was all about…well it's difficult because it was a 2 phase project only half of which was interesting. Half of which was interesting and had to do with whether GM alters the ecological behaviour of crop plants and there was another half which was a complete failure about whether you can track GM microbes in the environment. And that part of the PROSAMO project never got a single release of a microbe into the environment. It was a complete waste of time. So that is why I mean it was only a half interesting project. Because the microbial half I think was a complete failure. And I guess you are not interested in the microbial half, uh? Because it never did any release…but it's interesting for you to know it was half the money, half the project.

Nevertheless, the fact that the microbial experiments got funded reveals that microbes represented a potential business direction for companies.

The other element stressing that there was quite a lot of uncertainty about what the problematic aspect of releases into the environment could be is represented by the tendering process. U2 described the adverts used to recruit universities as particularly vague, so that they could see what kind of ideas academics would raise:

> Then what we did was, we devised basically adverts for the programme and asked for tenders from universities. We had a lot of interest. We left, if I remember, the adverts quite vague because we wanted to see what the academics would come up with. What they thought the issues were. So we, it was quite a broad topic, but we wanted to get ideas about where they thought the risk issues were and, you know, so we asked them to put in a fairly detailed project programme but deliberately from our point of view leaving it quite broad. We had a lot of interest.

This is confirmed by another academic scientist interviewee (A2) involved in PROSAMO, who referred to the tender in this way:

> I suspect it was quite broad, generally that's what happens. And it's deliberately made broad so you can kind of draw out the ideas and the thinking from the leading labs in the country and you see what comes along…and there would be a panel identifying, making a judgement on who was, who had the best programme.

In a nutshell, because the companies which were involved in biotechnology during those early years did not know exactly what were the prospects that genetic engineering was opening up to them and which issues might be problematic, they decided to initiate a pre-competitive research programme as a way to explore the potential and hazards of the new technology. A lot of the resources spent by industry are frequently used in trying to reduce the uncertainty of its activities. PROSAMO was meant to make this uncertainty a quantifiable and therefore manageable entity, so that it would be possible to plan long term business strategies and investments. A venture like PROSAMO certainly slowed down somewhat the progress of the companies involved in the field, but it was considered a reasonable step to make in order to reduce financial risk in future activities. The very failure of the micro-biology half of PROSAMO proves that this initiative represented a way to explore, with minimal financial commitment, what the actual feasible technological options were.

What this section actually shows is that scientists acted as an epistemic community[36] – that is, as a network of professionals whose expertise is relevant in policy-making as it helps policy actors to identify and define their interests in a domain characterised by uncertainty. Chapter 6 and Chapter 7 will return to this notion of the GM issue being managed within an epistemic community approach[37].

## *4.5 Summary and conclusion*

It is now time to summarise what has been said so far. Basically, PROSAMO can be described as a scientific research project that served two main purposes. On the one hand, it was meant to create public support for the release of recombinant DNA-containing organisms into the environment. On the other hand, it was aimed at providing a body of information that could influence the regulatory process. Indeed, industry not only was expecting regulation, but was eager to actively participate in its creation. These two purposes are closely related to each other and it was perceived that they could interact in a sort of cumulative way by the actors involved in PROSAMO.

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[36] See Hass (1992, 1996)

[37] To all these factors, I would add that the success of a company also depends on the availability of a highly qualified workforce. Although this aspect does not formally appear in the documents of the PROSAMO archive at my disposal, it is not difficult to imagine how important it is for industry to have a highly qualified workforce it can rely on. It is actually very easy to find this issues in governmental documents. The 1983 Communication of the European Commission to the Council we mentioned earlier – COM(83) 672 final/2-annex – explicitly and repeatedly points the attention to the need of research and training as a requirements for competitiveness in biotechnology. The Commission calls for "horizontal actions" that "are always precompetitive and bear on all branches of modern biotechnology. Their objective is the establishment of a supportive background for biotechnology, thus contributing to the elimination of barriers (technical bottlenecks, obstacles to the transfer of information, materials and know-how) which prevent the exploitation by industry and agriculture of the fundamental advances made by modern biology" (p. 39). The commission thus proposes "two projects for the training of European scientists and for the promotion of safety. The training action, in view of the fact that biomolecular engineering conditions the evolution of biotechnology, represents an essential element of the programme. It will cover key areas in basic biotechnology which are still insufficiently explored and should provide European scientists with adequate possibilities for mobility and the improvement of skills and knowledge" (p. 42). The economic relevance of the creation of know-how played an important, even if rather silent and subtle, role in PROSAMO. Given the pan-European nature of the companies involved in this programme and their involvement with DG XII and European research policies since at least 1984, it is easy to see PROSAMO, as it was conceived in 1986 in the form of a collaborative and precompetitive research project, as the offspring of this environment. This is clearly stated by I1:

> It was a scientific exercise. And also the scientists were not in place. You know, a lot of the scientists were not trained in the ecological area in Europe so we were trying to build up some expertise as well, in the academic community.

Regulation is a very important aspect of business planning and success, because it provides predictability and because it protects from legal attacks. But the material analysed in the previous sections clearly shows that some European companies wanted to follow a very particular regulatory trajectory for the release of GMOs – a trajectory that would have a positive impact on both public perception and on business competitiveness. In a nutshell, most companies involved in PROSAMO were coming from the pesticide sector, and they were facing a double constraint. On the one hand, they needed to improve their public image; on the other hand, they were facing the risk of technology substitution in a fast developing technological field. This last situation required companies to try to slow down the overall pace of development of the field so that they could have time to adjust their business practices and bridge the gap with those companies, like Monsanto, which were pushing the technology because they had managed to find synergies between their established products portfolio and the new technology. This could be done by promoting a regulatory approach that was fairly, but not excessively, restrictive. The question these big pesticide companies were trying to answer was: what kind of regulation can help to slow down the introduction and wide application of the technology without jeopardising its future potential? The answer was a pro-active, or precautionary, approach to regulation that required companies to take into consideration the possible hazards of their products and technologies before they were widely available and implemented.

This proactive kind of regulation had the structure of a case-by-case, step-by-step scheme composed of five levels of analysis, from the laboratory to the market, which had to function until a substantial body of information would be available to build a formalised risk assessment procedure- a procedure that could be used by the company releasing a recombinant DNA organism as a pre-clearance exercise.

It is clear that this approach would have had an impact on those companies whose products were already ready to be distributed. This proactive attitude also allowed the creation of expensive regulatory requirements, at least at the initial stages of the development of the technology – a period during which a company usually defines its technological competitive advantage. These requirements were basically aimed at raising the entry barriers in the field of biotechnology and at eliminating the competition from smaller companies that would have benefited from a loose, and therefore less expensive, regulatory regime.

The difference with the regulatory environment to which agrochemical companies were used to, at least in Europe, is significant. Indeed, the agrochemical sector was traditionally regulated in a reactive fashion. This means that information about damage to people and the environment was gradually collected and used in the regulatory decision making as the products were used. This approach, however, did nothing to stop competing products to exploit the market, at least as long as they were not proven harmful. But it also did not prevent any environmental damage until it was too late. Because of this, the public image of the agrochemical companies suffered significantly. It is no wonder then that companies working in this sector wanted to enter the new field showing a certain degree of caution, and that they therefore decided to go for a proactive regulatory trajectory.

Unilever had similar reasons, although it was also concerned by the acquisitions that chemical companies were making in the seed business. Monsanto had concerns also about negative public perception and damaging political initiatives, as these factors were already affecting its other activities.

The precautionary approach was therefore serving these two purposes – creating public support and slowing down the pace of development of the technology in order to have more time for exploring possible and non obvious synergies between biotechnology and the established business. PROSAMO needs to be understood mainly within these two logics. As an ongoing scientific experiment, PROSAMO could justify the preservation of a fairly slow case by case approach which could also reassure the public. Once completed, it would have provided a legitimate case for relaxing regulations. Public anxieties would have been eased by the authority of science.

PROSAMO can thus be described as being a shared interest within a cloud of different objectives. Because of this shared interest, PROSAMO could take shape and then be sustained as a collective definition of the public good. The next chapter will investigate how the government representatives and the academics contributed to this definition.

# Chapter 5 – PROSAMO, Biotechnology Policy and the Academic World

The previous chapter described what PROSAMO meant for its industrial members. It also emphasised that it is difficult to treat industry as a single policy actor, even when different companies cooperate on the same initiative. The various objectives held by each participant need to be taken into account when considering joint actions, because it is the attempt to realize these objectives that make joint action possible. If the social and political conditions were to change so as to jeopardise the achievement of the objectives, joint action would quickly become unsustainable.

The fact that PROSAMO was a joint initiative beyond the private sector, involving the public sector and the academic world as well, requires the picture drawn so far to be further complicated. A proper understanding of PROSAMO as a cultural object cannot be achieved without paying due consideration to the other social actors involved, namely the Department of Trade and Industry and the research centres appointed for the research work. This will be the focus of this chapter. Section 5.1 describes the political and economic context in which PROSAMO was conceived. This was such a complex and dynamic period of history that I have not been able to offer more than a sketchy and selective discussion. The section thus focuses on the science policy of Thatcher's government, which is essential for an understanding of the meaning of PROSAMO from the point of view of the policymakers, as illustrated in section 5.2. Section 5.3 examines academics' interpretation of PROSAMO with reference to the context outlined in the preceding sections. It shows how the new government's attitude towards science had a variety of interesting effects on scientists that find reflection in the way they approached PROSAMO and that current habits of thoughts about science and scientists in the UK tend to overlook. Section 5.4 offers a more general interpretation of the ambiguous role of science in the wider political and economic setting.

## *5.1 Biotechnology and the British government in the 1980s*

The participation of the DTI in PROSAMO must be understood in the wider political context of the time. At the end of the 1970s, the UK is still undergoing a deep crisis in which its manufacturing capabilities are the major casualties (Smith, 1984). The election of Margaret Thatcher in 1979 as new prime minister, signals a significant break with previous governments. Monetarism becomes the new philosophical basis for government action, and the concepts of free market and Strong State the grounding principles of the New Right (see Gamble, 1994). In a nutshell, Thatcher's political programme is characterised by a strong orientation towards a liberal economy – which implied little state intervention in the market in order to make the economy more competitive – and a strong emphasis on the authority of the state. Actually, restoring the authority of the state is deemed essential to the achievement of a market freed from distortions. These distortions are represented by high public expenditure, high direct taxation and by a strong bargaining power of the labour unions. According to Andrew Gamble (1994) "what the doctrine of the free economy and the strong state affirms is that the use of the force is justified when it is employed to defeat and contain those interests, organisations and individuals that threaten the survival of the free economy, either flouting its rules or resisting the outcomes that flow from market exchanges" (p. 39). As can be imagined, translating these principles into practical measures means a rise in socio-political conflicts that find ultimate expression, in the British society, with the 1981 riots in some major English cities and the 1984-'85 coal strike.

The New Right does not lack contradictions. For example, it is always difficult to find a compromise between the protection of private property and property rights and the protection of formal exchange equality among various economic agents. The latter aspect, however, means that a strong state for a free market "legitimates action by the state to suppress private coercion, monopoly and discrimination" (p. 41). It seems, however, that Thatcher's attitude towards monopolies was not so fierce after all. "The Thatcher government faced criticism in that by denationalising some public-sector companies, such as telephone and gas, it was creating new private-sector monopolies" (p. 42).

This attitude may be explained by the necessity which was felt of modernising the economy, making the British society more competitive and stimulating growth by providing incentives for entrepreneurial spirit. The lowering of the top income tax rate from 83 percent to 60 percent is part of this logic, but also the establishment of incentives for the development of new, highly technological industrial fields can be interpreted in these terms. As emphasised by Wright, "Thatcher government's science policy was to make research institutions more responsive to the needs of UK industries" (p. 62). But as mentioned in the first chapter, the development of these new industrial fields, such as biotechnology, required high investments in order to be pursued, and this condition put the multinational companies in a favourable position for such an enterprise. Martin Ince (1986) shows how after 1980 the government paid much attention to new technologies such as information technology and biotechnology[38]. As to information technology, in 1983 the government agreed to support a five year programme for information technology, pre-competitive and collaborative research in which projects carried out in industry were eligible for 50 percent of funding, and in which academic work had to be developed in collaboration with industry. A similar logic applied, with less coherence however, for biotechnology[39]. The 50 percent funding of industrial projects should be seen as a compromise between the desire of modernising the economy in perceived key sectors and of maintaining government financial commitment as low as possible[40]. Supporting the big companies was the best way to keep state's costs low. As pointed out by Ince, "giving industry only half of the cash is closer to the current administration's general inclination, but impairs the directorate's ability to control the direction of the work. It also severely restricts the contribution to Alvey [this was the name of the IT five-year programme] from small companies, which find it much harder to raise money for research" (p. 114). As Gamble put it, "on this view, markets are a

[38] For more on UK science policy see Goldsmith (1984). To have a taste of the (rather negative) reactions within Research Councils see the Advisory Council for Applied Research and Development/Advisory Board for the Research Councils report *Improving Research Links between Higher Education and Industry* (June 1983). On the financial commitment of the British Government since very early in the 1980s see New Scientist, 13 August 1981, 396-397 ("Science after cuts").

[39] The interest of the government, through the DTI but not only, towards biotechnology should not be surprising, given that UK commercial strengths after the '70s rested on the success of large pharmaceutical, chemical and food processing multinational companies, which were more likely to be affected by the advancements in biotechnology.

[40] For a more general perspective on changing science and technology policies in the 1980s and an early interpretation of their implications see Gibbons et al. (1984).

valuable instrument of policy for forcing through change. They are not valued primarily because they guarantee individual rights but because they offer the best way of allocating resources, providing incentives and stimulating growth. The overriding goals of economic policy become efficiency and modernisation. Other questions such as the size of the enterprises or the rights of particular groups or whether government should be centralised or decentralised are subordinated to them" (p. 42).

The need of a strong state then, emerges from the contradictions that would make many people unhappy, the workers on the one hand, but also the purist of a free market that guarantees the same rights to all the economic agents.

## *5.2 PROSAMO and the DTI: technology transfer and training, public perception, regulation.*

### 5.2.1 The LINK Programmes and the Technology Transfer Issue

It is not difficult to see PROSAMO within Thatcher's policy logic. As an attempt to explore the possibilities for industrial applications of biotechnology in a pre-competitive project, PROSAMO was a suitable contribution to the modernisation of the British society. That big multinational companies, particularly British ones, were involved was even better because they could respond with more efficacy to the significant financial challenges this new industrial development posed. The interpretation of PROSAMO as a business-oriented initiative is confirmed by a Unilever interviewee:

> At the time, the DTI, the Department of Trade and Industry, had some funding, matching funding for certain sorts of projects. We thought about funding this from industry. We also knew that the Department of Trade and Industry had funding for special sorts of projects with industry. They had a special term for it, it might be in the PROSAMO papers 'cause I can't remember, but they did match in 50-50 funding for projects, mainly with industry, mainly on innovation projects so to, sort of, stimulate industrial research again.

The name of the framework for cooperation between industry and the science base mentioned by the interviewee was called LINK. LINK programmes were fundamentally collaborative research projects, half funded by the government and half by the companies, which were aimed at developing new technologies and techniques to foster industrial competitiveness of British biotechnology firms. The government support for PROSAMO must then be seen as part of an overall strategy for biotechnology that was partly outlined in the Spinks report, a major report by the Working Party of the Advisory Council for Applied Research and Development (ACARD), the Advisory Board for the Research Councils and the Royal Society. Its chairman was former Research Director of ICI Alfred Spinks. Actually, the Spinks report argued against a pluralistic approach to supporting biotechnology, in which the various Research Councils and Departments with an interest in biotechnology independently chose what to fund. Instead, it recommended the implementation of a technology push policy coordinated by an interdepartmental committee in order to limit the problems and conflicts caused by overlapping interests. This committee would have had the responsibility to promote industrial applications out of pre-competitive research and development activities funded by the councils (Sharp, 1989).

The response of the government to the Spinks report was quite ambiguous. On the one hand, it recognised its role in the creation of an adequate environment to encourage private initiatives and enterprises. On the other hand, it argued against an inter-departmental committee because it was considered industry's role to turn the discoveries in biotechnology into desirable products and services. While this attitude seems contradictory, the rationale behind it is that industry is better placed to identify market opportunities and strategies[41].

In line with the Spinks report, however, the government acknowledged the need for a policy of technology push in biotechnology. Within this frame, the various research councils and departments had to set up a series of initiatives

[41] The end result of this attitude was, in fact, an increased political influence gained by industry. In a sense, industry filled a political vacuum that a less interventionist state inevitably left behind. But the downside for industry was that it also obtained much more visibility as a political player, and therefore could be considered much more responsible for the decisions taken at a political level.

aimed at identifying priorities and promote research in areas that were seen to be industrially relevant. Particularly the DTI, with its LINK programmes, played a significant role, as it was indeed originally conceived "to support the near-market or competitive end of R&D" (Sharp, 1989, p. 515). As pointed out by Yoxen (1985), "perhaps the key feature of the policy of the present government in relation to biotechnology has been the manifold links with the encouragement of the private sector activity in areas that have been dominated by academics or civil servants. […] The goal essentially is to accelerate the technology transfer by opening up opportunities to private investors" (p. 238). Ince confirms this interpretation when he quotes Roy Dietz, the head of the DTI biotechnology Unit at the time of PROSAMO, who claimed that "the technology needed to grow from the research's bench, and many developments were likely to be of such high risk that companies would hesitate to invest. The transfer of technology from academe was thought to need special encouragement, and to invite special government measures" (p. 119). But it is Coleman (1989), who worked for the DTI, who is more explicit on the purposes of the LINK framework:

> LINK provides an excellent framework for collaboration between industry and the science base. Used effectively we should increase the chances of U.K. research discoveries being translated into products and processes by U.K. companies. It is also an effective mechanism by which higher education institutions (HEIs) can increase their support from government and industry for targeted programmes. (p. 442)

The PROSAMO initiative, as suggested to me by a key player from the DTI Biotechnology Unit, should be understood against the background pictured above, in which the commercial ethos and the competitiveness of UK industry were the dominant aspects of the political thinking about science and technology. In order to foster competitiveness, the policy for industry at the time sought to facilitate technology transfer:

> The Department of Industry, in the early 1980s formed a view that biotechnology in general was going to be important for the future competitiveness of Britain in an industrial sense. […] The perception was

in Britain that we had excellent research in academia and that industry could make use of that research in biotechnology, but the perception was that many companies regarded it as very risky and so there was an argument for some initiatives in the centre to help facilitate the progress. [...] What DTI liked to do was to get companies and academic researchers into linkages in some way with the feeling that the views from the companies where the real potential was, for industrial activity, would inform the academics and help to influence where the research went. (DTI interviewee)

It is easy to spot the pervasiveness of commercial concerns. The government sought to achieve competitiveness by setting up research programmes that would enable industry both to exploit capable researchers by addressing their efforts towards industrially useful directions – in line with the idea that it was industry's responsibility to identify commercial opportunities for the science – and to transfer relevant knowledge and skills in house.

Training[42] is indeed another important aspect. The previous chapter (footnote 31) described how companies were trying to build, through PROSAMO, expertise in genetic ecology, and it was assumed that having a highly trained work force represented a competitive advantage. Coleman supports this view:

[42] It is not a coincidence that the concept of 'training' is becoming more important in policy discourses when commercial and utilitarian concerns become dominant. Barnes (1985) suggested that the 'training' is used instead of education when instrumental concerns become the predominant ones. The term 'education' is mainly employed "when a larger vision of science significance" is at stake, when science is considered for its own sake. But Barnes argues that the increasingly specialisation of knowledge basically increases the gap between science and everyday life. This dynamic has some consequences "for the way that scientific knowledge is transmitted, to the point that "it may perhaps be that in our schools, or in some of them, students are still educated in science in the full and proper sense of the term. But in the universities, and equally in other institutions of 'higher education', training is the name of the game" (p. 22).
Clearly, it is not the case that the concept of science education is dead. It is actually often expressed. But it would be interesting to see which term, training or education, is more frequently used in political debates behind closed doors, and who prefers the one and who prefers the other. From my analysis, my expectation would be that government officials would prefer to use the concept of training, while industry and academics would be inclined to use both training and education. This is because, as we will see in the next few pages, industry seems to value academic freedom more that government does (at least in the context of PROSAMO). In Chapter 8 we will see that 'education' becomes an important aspect of the debate.

> There is a clear evidence in the research base and in industry of a shortage of highly trained staff. […] The demographic trend will increase competition for young, trained scientists and engineers and the re-training of staff in industry through specialist short courses will increase in importance […]. (p. 443)

It is true that Coleman writes in 1989, three years after PROSAMO conception and the year it formally started. But we have learnt in the previous chapters that issues of competitiveness, technology transfer and the need for qualified workforce had been very relevant issues since the early 1980s. Therefore, Coleman contribution can be seen as mirroring a long term process of thinking about the relationship between science and technology, industry and government policy.

### 5.2.2 Public Perception

There had been many of these LINK programmes, but it was clear within the civil service, as it was for companies, that technology transfer and training could not, alone, guarantee the economic success of British industries. In his 1989 contribution to the wider debate on biotechnology, Coleman identifies other fundamental elements contributing to the commercial success of biotechnology applications: public perception of biotechnology and regulation[43]. As to public perception:

> There is a good case for seeing the public perception of biotechnology as a key factor in the climate for investment. The term 'genetic engineering' is capable of much misinterpretation. […].
> Improving the public perception of a technology of such scope is no easy task and it is clear that an aggressive campaign of publicity could be counte-productive. More fruitful, I believe, would be the provision of material designed to set the new advances in context and to provide a

[43] Again, these are not simply new, 1989 issues – even though 1989 is a troubling year for the public and regulatory debate on genetic modification both in the UK and in Europe, with the publication of the 13th Report of the RCEP and the preparation of the European Directive on Releases into the Environment. These themes have been present since the early '80s. The previous chapter should have made clear that regulation and public perception were important topics in the conception of PROSAMO.

> background of balanced information against which the inevitable scare stories can be set. (p. 442-443)

It seems clear, in light of Coleman's words, that the creation "of expertise in genetic ecology" that PROSAMO was trying to foster, as I1 put it, was not just an interesting endeavour per se, but it was linked with the wider objective of creating a positive environment for investments. The creation of expertise in genetic modification technology seems to fit nicely with the need to provide a "background of balanced information", and I would add reliable, authoritative information. My interview with D1 is revealing. Explaining how PROSAMO got started, he said:

> And there was a lot of excitement as you would have found out about its uses [of biotechnology] in agriculture. [...] There were however concerns about this [...]. But what we thought was "there needs to be some move towards authoritative assessment of risk" because the environmental groups were very exercised about risk...we thought in an exaggerated way. In fact I now still think it is. And we thought the best way of setting that, or informing the discussion about it was...with a more objective risk assessment.

As for industry, then, even for the civil service PROSAMO was conceived as a defensive strategy, as a way to oppose the authority of science to potential criticisms of the environmental lobbies that seemed to be so successful on the other side of the Atlantic. My DTI informant emphasises that PROSAMO should be seen more as a voice within a wider debate about the environment, rather than as part of the LINK framework:

> Because the characteristic of the debate about GMOs in the environment hasn't been that it was really well informed. And on the one hand the environmental groups exaggerating risks, on the other hand the firms underplayed the risks. And there needs to be something in the middle that gets some objective understanding of what this is about. And we thought PROSAMO not as answering all the questions, but beginning to

> show what sort of experiments you might need in order that you answered them.

### 5.2.3 Regulation

But besides being an instrument to influence public perception by replying to the foreseen concerns from environmental groups, PROSAMO – in the intention of DTI – was aimed at influencing regulation. It was not, like it was for the agrochemical companies, an attempt to influence public perception through a new, proactive form of regulation. The concerns of the DTI were more straightforward and probably less subtle. According to the DTI interviewee:

> From the point of view of DTI, we saw in the department that the regulatory system that didn't reflect the reality would harm the commercialisation, I think. I mean DTI's main concern was to have commercially successful companies. I mean, that is what it is there for. And the debates in Whitehall was always along these lines. It was crucial in this. And it sees that a regulation that is not founded, is not rational in some sense, inhibit sensible initiatives in commercialisation. And so it didn't want to see unrealistic regulation. It wasn't opposed to it. It wanted regulation because obviously one needs that. But it is important that it is soundly founded in the science, really. We were worried that the argument of the environmentalists, which was sort of more emotional and not well founded in the sciences, would resolve in regulation that was overly restrictive, which is in fact what actually happened.

This last comment is actually very revealing. First, the DTI did not want an overly restrictive regulatory system, probably because it was already clear that the USA, UK's major competitor in biotechnology, did not consider the release of genetically modified organisms as deserving its own regulatory scheme (see Ch. 4). Second, it is interesting that in order to avoid having a restrictive regulation, this regulation needed to be founded on reality unveiled through science. But the logic behind this claim is that there were certain expectations about what the reality was before the actual experiments started. The 'expected reality' was that the release of GMOs into the environment was not dangerous. In fact, this attitude towards regulation reflects the more general belief held by the majority of the scientists that releasing GMOs into the environment was safe. As put by the interviewee in another moment, "the scientific community thought the views of the environmentalists were wildly exaggerated, and if they'd really understood more about the technology, they wouldn't be so against it". So even though, formally, people were saying they were looking at the environmental consequences of releasing GMOs into the environment, they were in fact trying to build an authoritative as possible proof that they were safe, to reassure both the public and the regulators.

At this point, there are two things that are worth emphasising. First, the regulatory debate was imbued with commercial considerations. Second, it is plausible to argue that the main regulatory concerns, at least in 1986 when PROSAMO was first conceived, were springing from concerns about European moves towards European regulation. The UK regulatory system in biotechnology was heavily based on experts' advice, and scientists had a significant role in addressing the regulatory policy. Given scientists' voice in regulatory matters in the UK and their shared belief about safety of field releases, it is clear that the main concern in the UK was the direction that European legislation on this issue would have taken. A short abstract from Coleman's paper seems to confirm this. He claims that:

> Successful innovation depends also upon a regulatory regime balanced correctly between encouraging innovation and protecting the environment and the consumer. [...]. There is evidence that the balance is not right in some European countries and consequently production is being transferred in Japan.
>
> Many of the most significant opportunities in biotechnology involve the release into the environment of transgenic organisms, whether microorganisms, plants or animals. There is a draft European directive for the regulation of such releases, which contains many unsatisfactory features [...]. The caution arises in part from powerful environmental lobbies but also from an understandable wish to know more about the risk entailed by such releases. There is a central need for authoritative methods and studies in risk assessment in this area [...]. There is a need

> for earlier and better communication between regulatory authorities, industry and the research base to facilitate regulations that protect society without imposing unnecessary burdens upon innovation. (p. 443)

This last quote confirms that a study like PROSAMO on risk assessment was expected to affect regulation and the attitude of certain European countries. The reader should remember U2's comment in the previous chapter, when describing PROSAMO as an instrument to compensate for the lack of experience on regulation of biotechnology of some European countries. But it also shows how important the European dimension was within this pervasive commercial logic. Indeed, despite Thatcher's antipathy towards the European Community, her government recognised and accepted the Commission's calls for an integrated policy for biotechnology. As mentioned earlier, the large common European market for coming products was considered essential if European companies were to recoup the large investments required by biotechnology R&D. However, a real common market would have been impossible to achieve without a harmonised regulatory framework. As the Unilever informant argued, achieving a common market would have been difficult because of countries with less experience in dealing with GMOs and therefore more driven by environmental concerns. A hostile or fragmented European regulatory environment would have in fact compromised the competitive advantage of British firms, which needed to be able to access the whole European market. British political action could not therefore avoid being involved in European negotiations. PROSAMO was hoped to be used as a lever in the early stages of these negotiations by the British political establishment. Reassuring data would have, optimistically speaking, set aside other EU countries' early concerns and possibly fostered public acceptance of the new products in the near future.

### 5.2.4 Summary

To wrap up the argument so far, the new political philosophy of the Thatcher government focused on reducing as much as possible state expenditures and, at the same time, on modernising the British economy by creating an adequate environment for private investments. Public money for science was therefore directed towards those fields that were more promising from an industrial point of view, and funds were especially made available for pre-competitive research projects where academic scientists were required to collaborate with industry. The main objectives of these projects was the development of useful new technologies and techniques that British industry could have then employed in order to maintain its competitive edge in a global economy. But more generally, it was thought that making industry and scientists work together would help the transfer of technology and know-how and aid the training of industrial scientists. A highly skilled work force, combined with a great awareness of commercial needs and opportunities was expected to influence the direction of scientific and technological development towards a more commercially relevant output.

PROSAMO, from a political point of view, was all this and even more. Commercial concerns, in fact, were expressed also in the perceived need to create public support for the new technology and its potential products. This was particularly true for the food processing industry. Without people willing to buy the new GM food products, there would have been little sense in investing in recombinant DNA technology. And the willingness to buy is even more relevant in a food market, in which the social cost of renouncing new products is very low in the presence of readily available, relatively cheap close substitutes.

The policy makers however, at an early stage of development, were even more worried about regulation. There was an informal agreement, within the scientific community, that GMOs released into the environment would not have become more invasive, or contributed to the invasiveness of related varieties. But there was no formal expression of this agreement, and the lack of a formal, scientific and authoritative risk assessment framework could have favoured the environmental lobbies which were starting to invest some resources in the biotechnology issue and may have turned the public against the promising recombinant DNA technology. This in turn could have influenced the regulators, particularly in the European context. When in 1986-1987, the PROSAMO project was discussed among companies and the DTI, European regulation was expected. For the DTI, PROSAMO was an attempt to influence regulation, particularly the European one, at an early stage of the debate, so that it did not end up being too restrictive compared to the 'expected reality'.

### 5.3 The academics

The Thatcher era represented the realisation of a process of redefinition of science and technology policy thatstarted towards the end of the 1960s and that tried to replace, to say it with Wright's words, "the former protection of the autonomy of the British science with a utilitarian emphasis on accountability" (p. 50). According to Ince, there is a stronger stress from the government on making researchers aware of applications of their work, but application is increasingly equated with exploitation in industry. Corporate interests supposed to provide knowledge of the market's wishes for new products, increasingly set the agenda for publicly funded research" (p. 44). Barnes (1985) is on the same wavelength when he claims that scientists "are having to think more and more seriously of how to justify their research to those key outsiders who ultimately control the purse-strings, which means thatconsiderations of utility, and short-term utility at that, are receiving greater and greater priority even in universities and other institutions of what used to be called 'pure science'" (p. 6).

It must be acknowledged that science, and scientists' work, has long been affected by scientists' dependence on external funding bodies. However, as suggested by Nelkin (1976), with government funding "there was assumed to be a natural coincidence between the needs of the stateand those of an autonomous scientific community" (p. 21)[44]. But when turning the attention to Thatcher's policy programme, with its focus on cutting state expenditures and making industry responsible for turning scientific knowledge into useful devices and services, it is clear that the image of autonomy that the scientific community has long fostered is undermined. Industrial interests and views inevitably come to play a greater impact on the direction of science and technology development, moving scientists towards uncomfortable positions.

[44] Although Nelkin mainly refers to the US situation, similar considerations can be hold also for the UK. The regulatory experience for the contained use of recombinant DNA organisms follows this logic. The monopolisation of regulatory agencies by experts may be seen to reflect the coincidence between the needs of the state and the needs of the scientific community.

With the boundaries of science and the autonomy of science so bluntly questioned, it is legitimate to assume that scientists' behaviour and their perception of themselves may have changed too.

### 5.3.1 Science, scientists and autonomy

And autonomy, or freedom, seems indeed one of the issues that emerged from the interviews. A Unilever informant, when talking about the academics, recalls a sort of tension between the needs of the academics and the needs of industry:

> Because the focus had really to be risk assessment for a real purpose, for companies who wanted to release micro-organisms or plants into the environment. So there was always an end point there because although this research [PROSAMO] was gonna be very open, it had to focused on the release issue. […] So while there was as much academic freedom as you could possibly get, there was a feeling that it had to...we wanted, after the three years, some concrete piece of work which would say "yes, you do get gene flow in Brassica, but does it matter?"

The independence and freedom of the scientists seems to be an important issue for an ICI interviewee as well (I1) who acknowledged that he was there to defend the interests of those who were paying his salary, but who also said the following, when asked to describe how the relationship with the academic scientists was:

> […] I tried, form ICI point of view, I tried to get more scientists involved in what was going on. But it only works if you allow the universities some independence. It's a very hard relationship because…to describe…if it was to work, the work from Imperial College or from Cambridge had to be independent. You know, I could not be seen as trying to influence it but I would like to know what it is, their findings, as early as possible. So it's quite a delicate relationship. And it's a relationship that causes always problems. But again I don't think, I cannot think of any company which was trying to put under influence, or even trying to influence at all

> what the academic research was doing. We were too old and too wise to do that.

In a more implicit way, another ICI interviewee confirms that scientists' freedom was an important aspect of PROSAMO:

> It has to have an academic involvement; there is no point in doing this as a company. […] You have to have a broad constituency so it can't be seen to be just coming from one place but, you know, it was giving it strength, if you like, against some obvious criticism that says "ok, these guys set it up in a way to give a particular answer" so you have to make it robust, if you like, in terms of the science and it was always desired to be something…"ok, this is research which we conducted and is public and it's going into the scientific literature where there isn't much background".
> [...]
> The whole thing was intended to say "this is a piece of academic research which should be published" and that is one of the reasons for doing it…is to get some information and some data in the refereed literature so you have some things to compare other crops to.

Even the Shell representative uses the term "academic" to describe PROSAMO:

> You know, I think we really did go into it in a very academic way. […] And it really was very much saying "let's see what is lacking from the research that would help with being able to conduct experiments safely. So it was a very academic programme effectively. And it is difficult to find funding of that nature from the academic research so the government really separately and even the agricultural research council for obvious reasons clubbed in with agricultural companies to provide the money.
> […]
> They [the academics] were very much allowed to do ther own thing. It was a very straightforward project for them. We had very distinctive aims and they did their own thing, basically.

The concepts of "public" and "academic" research seem to be grounded in the stereotypical image of the autonomy of academic science. Industry reliance on public scientists was a way of borrowing public science's cognitive authority for public perception and regulatory objectives (see also Chapter 6). These observations are important because it not only shows that the image of science as an independent enterprise, freed from external pressures, was still alive, but that it was considered a valuable aspect for those who were supposed to influence, and actually often accused of influencing, it.

### 5.3.2 Scientists are frustrated

It is interesting at this point to see what the perception of the academics involved in PROSAMO is of their relationship with their partners, the industrial people and the government officials. The views that I am about to report are the views of only some of the scientists involved. As I explained in the third chapter, I did not interview the scientists doing the work on the microbiology side. This decision was taken in light of the higher visibility that the plant experiments enjoyed in the public sphere. I believed that focussing on the most visible part of the project was more likely to bear connections with the development of the GM debate in the 1990s, and that it could, from this point of view, be more relevant in the context of the current accounts of this debate. Learning why the microbial work did not gain the same attention would be an interesting enterprise, and some ideas will be provided later. But it is not the focus of this work.

Now going back to the senior scientists I interviewed, the first interesting thing to see is that the collaboration between academia and other institutions such as government departments and industry was not actually perceived very positively. One academic scientist says:

> So I put a proposal very late and in two or three rounds of interviews of various sorts…it was quite competitive because a lot of people wanted to do the research. I'm not quite sure why now with hindsight because it

> was a pain in the neck, I mean it really was. Much more trouble than it was worth scientifically.

And when asked to develop this sense of frustration:

> Because the associated work…that's the right word for it…the associated commitments, you know, attending the meetings, attending risk assessments, dealing with government advisors, and this was before ACRE, it was before the Advisory Committee on Releases into the Environment, but they used a number of our proposals as the guinea pigs if you like so we had to get permission for our experiments before ACRE itself existed although there was a forerunner to ACRE whose name I can no longer remember.

This sense of frustration is expressed many times during the interview. The same scientist places particular emphasis on the bureaucratic nature of the project, and to the endless requirement of reporting back to the sponsors:

> **Q**: Once you won the grant did you receive instructions by the sponsors?
> **A**: Ah, the bureaucracy was unbelievable. Every single thing we did was done in a committee of the industrial sponsors and the government representatives. So the first thing we had to do was to write all the applications to government to get permission to do the work.

Given this answer, I tried to understand what the main cause of this bureaucratic nature was:

> **Q**: Would it have been bureaucratic anyway, had industry been the only sponsor?
> **A**: No. It was because they led themselves into this trap, which is a government error, I think, of treating GM technology as a completely new problematic area of human life.
> […]
> **Q**: The bureaucratic thing was then related to governmental involvement?

**A**: Exactly. It was the government perception. […] in 1988 some bureaucrats decided that GM had to be treated differently. And that was the seeds of all problems. Therefore it became a bureaucratic issue, the precautionary principle was introduced. I'm sure you've heard a lot about that. It's absolute bullocks scientifically, but it sounds good for a politician to be able to say.

These sections of the interview reveal that much of the blame for things gone wrong later is given to the government approach to biotechnology. Of course, I am not arguing that this analysis is correct, but it is certainly very interesting that the main target of his frustration is the "government", the "politicians" or the "bureaucrats". This attitude seems to suggest that government science policy indeed changed the self identity of the scientists by changing their routines and activities, more than industry involvement seems to have done. Again, the same academic says:

A scientist doesn't like meetings. And we had to go to hundreds of meetings. And every turn, we had to report back, endless report writing, very very dull, that's one of the reasons I said I'm not sure I would do it again.

Report writing cannot of course be just the consequence of government involvement. When asked about his relationship, as an academic scientist, with the industrial scientists he said:

Not at all, except insofar as they were in the committee that were regulating our every move.

And indeed, the Shell representative would confirm this while describing his involvement in PROSAMO:

Now, regular periods over the next few years, the technical and industrial and government would go to the locations, talk to the scientists, look at the progress, see how the money was being spent, see what was going on and now half of the way or some of the way through the programme I actually moved job and I think a number of my colleagues did.

So it seems that the bureaucratic nature of PROSAMO, the "endless report writing", and the constant monitor of scientists' actions cannot be attributed only to the involvement of government. However, the very negative description of government's participation is particularly striking if compared to the description of the relationship with industry:

**Q**: Did they [the industrialists] participate in any way to the experiments?
**A**: No…well, they provided the GM seeds…In that sense it was good because we were completely independent from the people who made the seeds. […]
**Q**: Do you reckon any problematic aspect in dealing with industry?
**A**: No…they were fantastic. That's exactly like one wants scientific industrial interactions to be. Very business-like, very straightforward.

The other leading scientist involved in the plant project of PROSAMO made a similar remark about industry:

**Q**: Did you receive instructions from the commissioners on the way to do the experiments?
**A**: The sponsors of the research? A little bit. Generally how it's done is we propose a particular way of doing things and there would be a discussion with the regulators and with the companies. I would say that the regulators had a bigger influence on how the experiments were done. Considerably bigger influence on the way experiments were done. More than industry. Because essentially we were doing it for the regulators' benefit, so we had to satisfy their requirements.

But the strongest expression of frustration is provided again by the first scientist, who is the only purely academic scientists involved in PROSAMO whom I managed to interview[45]. It is an expression of frustration that coincides with resignation:

> […] The government and the public demonization have gone so far that for the scientists it doesn't matter anymore. It's not persuasive…nobody asks our opinion. Because the government has gone so far and the opposition has gone so far. It was interesting looking at the television yesterday to see if they could get any scientist to speak up in favour of these trials with the GM potatoes, and the scientific arguments were very very poor. They obviously, they couldn't find anybody good to speak out of…
>
> **Q**: Do you think this is a sign of something?
>
> **A**: Tiredness? Realism? Why would a scientist, realising the mountain is so big, bother to climb it? What's the point?

### 5.3.3 Scientists have their own agenda

It is important to comment a little on this last quote. It seems that this sense of frustration felt by the scientists, this not being able to make their point of view have an impact has matured over time. It was not always like this. Scientists have tried but are now "tired", they have become "realistic" about this. But they weren't so when this debate started. They actually had their own objectives, as industrialists and governmental organisms had theirs.

It is important to emphasise that even academic scientists can pursue different objectives than the sponsors. All the participants in PROSAMO had interest in this programme being done, but with rather different aims. Some industrial members wanted to regulate the new field in order to increase the calculability of business opportunities. Other companies were more interested in public perception issues, and regulation was just an aspect of this wide issue. Civil servants were concerned with creating the right environment for industrial investments. Amid this plethora of objectives, even scientists had a few. For A1,

[45] The other leading scientist was actually working for the Plant Breeding Institute when discussions about PROSAMO were conceived. I recognise of course that being part of a research council institute is different from being part of a university department. Nevertheless, for the sake of simplicity, I decided to treat publicly funded scientists in the same way, despite them belonging to rather different institutions with rather different objectives.

for example, PROSAMO meant the possibility to develop an experimental protocol that could be used in other contexts:

> I think what attracted me to it [PROSAMO] was that we could do some interesting experimental work that wouldn't be funded by standard routes and that turned out to be true. We could test some experimental protocols about relative importance of the different ecological processes that were, as it were, likely to prevent invasion.
>
> [...]
>
> ...we were using the funding to develop experimental protocols that would have been very useful in other sorts of ecological work.
>
> [...]
>
> The work was very successful, establishing this ecological protocol we used subsequently in all sorts of other work that had nothing to do with GM. So it was an excellent protocol and we would never have tested it had we not had the resources made available because it was GM.

The bit of interview reported above is revealing for another reason. Chapter 4 has shown that a particular definition of what GMOs were, given by industrial members, was functional to their objectives of slowing down regulation and imposing high entry barriers for new entrants in a field that could have jeopardised the product portfolio of some of the big companies. It was also useful in reassuring the public that this perceived new area of enquiry, with its disquieting uncertainties, was dealt with properly. From the claims of A1, even for the ecological community the definition of GMOs by the process they are made rather than the features they have could be partly functional to their objectives, at least to those of the ecologists involved in PROSAMO[46]. In particular, the expression "we would never had tested it had we not had the resources made available because it was GM" shows that it is because GMOs were defined as a distinct category that academic scientists, at least those in PROSAMO, were able to pursue their aims.

[46] Again, I prefer to avoid  a big generalisation without having had the possibility to analyse different research programmes that had to deal with biotechnology.

Besides this, even academics were interested in regulation, even though this interest was mainly due to a political requirement more than an actual belief in the dangers of the GM technology. In part, PROSAMO was an attempt to build, together with the regulators, experience for future applications to the supervisory group. A2, who at the time was working for a publicly funded institute (PBI), said that PROSAMO was an opportunity to obtain more information that could help getting approval for other experiments. PBI in the early 1980s was working on genetic engineering to modify crop plants. A2 recalled submitting in 1986 a proposal to the IISC, under the ACGM, for an experimental release of GM potatoes, which was the first proposal of this kind in the UK and one of the first in the world.

> There was a lot of dialogue with the regulators at that time, because it was my first experience with doing this, and it was their first experience as well. So we had to work things out as we went along.
> […]
> The first two years [86-87] we removed all the flowers and this was a requirement from the regulators, to remove all flowers to prevent any pollination. […] so during those first two years the regulators said "if you want to grow potatoes under field conditions and not to have to remove the flowers, then we need data to learn about the distance of pollination". So it was in 1989 that we did our first gene flow experiment. And that was funded by PROSAMO […]

So, scientists working within publicly funded institutes and laboratories were not simply jumping from one sponsor to another in order to have the money to keep working. They actually had their own agenda – which it appeared could be realised through PROSAMO, as well as the agendas of the other relevant social actors like the industrialists and DTI – and they wanted to give their input to the regulators. As A1 once again said to me, "the work was done to demonstrate that what scientists were saying was in fact correct".

In a nutshell, academic scientists had their own agenda, and it is doubtful that they would have embarked on such a project had they had the independence they needed to obtain their aims.

### 5.3.4 Academia as an active economic agent

There are other elements that indicate that academic and public scientists were acting quite independently from the other institutions, and that this independence was actually a valuable resource. Let me expand briefly on this. As has already been examined, one of the main rationales behind the funding of research institutes and university departments at the time of PROSAMO was the creation of wealth. Research that represented a contribution to the economic success of the country was the most likely to receive public financial support. On the other hand, even the most promising areas of science and technology were affected by cuts in public spending. This means that while it is true that for scientists biotechnology was an opportunity to justify their work and therefore maintain public support as much as possible, Thatcher's cuts also meant that they needed to diversify the sources of financial support and to find alternative ways to raise the money that could allow universities to keep doing research. Industry was of course one of these sources, but it would be misleading to see universities as exclusively subservient to the will of industries. This study actually suggests that university departments should be understood more as business partners and competitors rather than simply employees. A glimpse of this aspect is offered by A1 when he describes the relationship with industry as being "very business-like, very straightforward". But the most interesting example of this lack of deference towards industry can be found in the long negotiations that characterised PROSAMO as well as other similar research programmes in which universities and involved companies argued with each other because of intellectual property issues. U2 first introduced this problem, which initially appeared to be a problem among companies only:

> One of the big problems that delayed the programme quite substantially at one point was the contract that the industries had to sign. One or two of the companies had big hiccups about potential intellectual property and it would, the lawyer were abs…dreadful…in the end most of us said "this is nonsense". We've entered into this saying "this is a pre-competitive issue. The knowledge is going to be used for everybody, not

just for us but"…and we would doubt that there was any intellectual property coming out of this. But a couple of companies had a real issue and in the end the rest of us almost said to them "you're going into a room the two or three of you with the lawyers and sort it out and come out because otherwise it is going to fall over". And it took...it took a long time. It delayed the start of the project by about five or six months.

Later, a non recorded conversation with U1 revealed that the issue of intellectual property actually involved universities as well, which were trying to maximise their source of income. As D1 confirmed:

> The academics, it was in the late 80s, we were talking about the project, awareness of the need to protect intellectual property was much more recent in academics. They were beginning to perceive that, you know, if universities research institutes have protected their intellectual property appropriately, that they might earn some money from it. They hadn't been so slick about that in earlier years. […] And they were keen to negotiate an arrangement that suited them so there was some discussion about that in PROSAMO.

Similar discussions took place during the development of other collaborative research programmes. PROSAMO was not an isolated case. For example, before PROSAMO, most of the companies who were involved in it also participated in another pre-competitive collaborative research project within the LINK framework: the Plant Gene Toolkit (PGT). The PGT was about developing new technologies that could be used in making new genetically modified plants. Coleman (1989) introduces the PGT in the following way:

> My third example is the PGT, which seeks to establish sound practical procedures for introducing foreign genes into key crop plants. The project draws together work at two AFRC institute and two universities. The researchers prepared an integrated programme of work to companies and DTI. Following expressions of interest, there needed to be detailed agreement on confidentiality, intellectual property and project management, because theresearch, although of high risk, was

> targeted towards significant commercial opportunities. Eleven companies, from multinationals to new research-based companies, stayed the lengthy course of negotiation to set up the collaboration that has seen the largest financial contribution (£ 1.5) from industry to date. (p. 441)

It is D1 who clarifies what the negotiations in the PGT entailed.

> […] concerns about the intellectual property which made the setting up of the PGT – another one I used to run, I did that too – that was what made that one harder, because people were concerned, I mean, the researchers…they wanted to be sure that that would be owned properly and properly protected. And so yes, there was lengthy discussion about that in the Plant Gene Toolkit […]

It seems clear at this point that the focus on wealth making did not simply make academic scientists subservient to external pressures and interests. On the contrary, they were pushed to defend their own interests and independence with even more determination than ever before. The negotiations that took place both in PROSAMO and in the PGT were the expression of a scientific community that was underlining its independence by becoming a very active and wilful socio-economic agent. Public scientists attitude towards the sponsors in PROSAMO and in the PGT resemble an agreement between a company specialised in logistics and its clients. It is certainly true that the company must meet the needs of each of its client, but it is also the case that it cannot allow one client's needs to jeopardise the business of the others. In this perspective, it is more desirable to lose an uncomfortable partnership with a company which is too difficult than to jeopardise the entire business. By behaving is a similar way, science as a profession is able to keep alive the traditional conceptualisation of science as an autonomous enterprise. As it is the role of a company specialised in logistics to organise the storage and distribution of its clients' goods in a fairly autonomous way, so it is the purpose of the public scientist to undertake the experiments and deliver the data to the sponsors in a fairly autonomous way. This process of outsourcing allows the companies to reduce their costs significantly and to have better results. This is also the opinion of A1. When asked how common it was for industry to hire universities to undertake the experiments he said:

> Very common. It was much more objective and much much cheaper. For them to do the work in house would have cost them between five to ten times as much because of the overheads. So the universities in those days didn't have full economic costing. They could do research in universities at a fraction of the price they could do by themselves. And it gave a degree of independence, of course.

The difference from the traditional conceptualisation of autonomous science is that now the scientist needs to actively affirm this autonomy, while during the Cold War era, when this conceptualisation became predominant, the concept of 'autonomy' was more of a rhetoric device which was functional to a scientific community that was trying to conceal, more or less consciously, the fact that military reasons were actually behind most of public support of science (see Calvert, 2001).

### 5.3.5 Blaming the government

The emphasis on wealth making imposed by Thatcher's science policy may induce many to think that the concept of autonomy was doomed in the 1980s, under the pressure of industry's interests, now explicitly legitimated to interfere in the definition of the public science agenda. Interestingly, however, the industrialists involved in PROSAMO who talked to me actually seemed to cherish academic autonomy, as seen.

From the scientists' point of view, in the context of PROSAMO and, more generally, of genetic engineering, it is the public sector that appears to be the bogey, the villain of the piece. My interview with D1 seems to confirm that the government had a more aggressive attitude towards academic scientists. D1 is indeed the only one of my interviewees who talks about academic freedom as something rather problematic:

> I think there was frustration in some cases about persuading the academics to do what they agreed to do. That's another sort of general problem with these things. You set up an agreement about what the work is going to be but then the academics start and they think, in fact, "ah, there is an interesting aspect over there", and often shoot over to that, whereas we and the companies wanted them focussed.

It is true that even U2 introduces the need of focus in academic work, but it is also true that PROSAMO is described as an academic kind of research in the first place.
The need of limiting academic freedom is also expressed in the already mentioned contribution by Coleman (1989), who describes the "biotechnology policy and achievement" between 1980 and 1988:

> Some anxieties remain. The academic community is concerned at the exclusivity of research clubs and what can be seen as a break from the tradition of peer review towards decisions in 'smoke-filled rooms'. In a broader perspective, it is plain that the projects in SERC clubs are subject to an extraordinary degree of review, both by academic peers and by co-sponsoring companies. And in projects in which companies are providing collectively at least 50% of the cost, it is clear that weight must be given to their views. (p. 441-442)

During the discussion after his contribution, he makes his opinion even clearer:

> Furthermore, when it comes to biotechndogy, and I stress technology rather than science, the views of industrialists and the market place are more important than the research scientists' in the institutes. Thus, I believe that research managers covering the view of the whole community can sort out the relevant priorities and commission the appropriate research rather better that leaving it solely in the hands of a research institute. (p. 445)

The idea of research managers who can identify the relevant priorities was actually rather controversial. While from the quote above it seems that the government and industry were on the same wavelength on numerous issues, including the need of a research manager, my data reveals quite the opposite. PROSAMO indeed had a full time project manager nominated by the DTI, but its presence was not particularly appreciated by industry members. U2 recalls the events in the following way:

> […] Then we had another slight hiccup. We got the adverts and everything. But the DTI decided that it wanted to have a full time project manager to oversee it. I think most of the industrial members really didn't want it, we felt that we were gonna waste money for paying for somebody, if you know what I mean. Because we all thought, you know, paying out of the PROSAMO budget a full time project leader…we didn't really need that. Then we thought the industrialists could do it.
> […]
> And they were very insistent and in fact it was almost a condition of them giving their money that we had a full time project leader […] so that caused issues further down the line.

### *5.4 Interpretation*

It is now possible to spend some time commenting upon what has been discovered in this chapter. The first interesting thing to notice is that PROSAMO was thought to be politically useful within the European context. This is something that the previous chapter has already highlighted, but in this case it is even more interesting. Through PROSAMO as an authoritative risk assessment exercise, some government officials, particularly within the DTI, were hoping to contribute to the European-wide debate on releases into the environment, aiming towards a fast and agile regulatory regime. In other words, PROSAMO was a persuading tool, a way to create consensus in a context where coercion, the Strong State policy, was not applicable. Within the UK instead, the government was clearly more interested in having scientists under control, in line with the slightly authoritarian slant typical of Thatcher's approach. Coleman's words envisage a new role for scientists, in terms of their contribution to the nation's welfare. Scientists' efforts needed to be oriented towards industrial and commercial applications, and industrialists' views had to bear more influence than those of scientists in deciding the direction that publicly funded science should have taken.

This may explain why the DTI top management initially refused to fund PROSAMO, as they did not view it as being particularly useful in terms of scientific development. Indeed, PROSAMO did not really have a technological aim and this potentially placed it out of remit of the LINK programmes. My DTI interviewee remembers the laborious process of obtaining authorisation to fund PROSAMO, maybe a sign that its aims were not exactly in line with the science policy priorities as established by the LINK programmes:

> […] I had difficulty inside the Department inside DTI in persuading those who held the money bags that they ought to spend on PROSAMO. And obviously I had to persuade people that it's a sensible thing and show that I will manage it appropriately. They were weary of it, because I think it was aimed at this regulatory issue and the way I managed to unlock their assent was to get an involvement in PROSAMO from AFRC. When I first went to persuade them they said "no, we shouldn't fund this", I went back and said "look, I have now persuaded AFRC that they will fund a bit of it" and DTI said "oh, ok then". So it was a ruse I used to get the money from DTI. They would spend only if the AFRC was there. AFRC involvement in it was simply to give a bit of money in order that it facilitated the release of much more money from DTI.

The government's general orientation towards commercially useful innovations and its 'strong state' approach may have made it less receptive towards the use of science as a tool for creating consensus, consensus which was necessary at the European level. It is true that the microbial side of the initiative was aimed at discovering new techniques for the detection of modified microbes in soil, but it is clear that the main purpose here was a regulatory one. Although it is difficult to prove, it almost seems that the microbiology programme had been used as an excuse to make available and to receive funding for the plant programme, where much more interesting things were going on scientifically, technically, commercially and politically. This may also explain why the microbial project did not receive much attention in the end, and actually ended up being considered a failure, as seen in the third chapter. The following section from my DTI interviewee is very interesting from this point of view:

> **Q.** It is interesting that you place much more focus on the agricultural bit…I know that PROSAMO was a sort of double project. It was working with micro-organisms as well.
>
> **A.** Yes…not much happened on the micro-organisms fund. One, because the companies weren't interested, because it didn't represent as big an opportunity for them as the agricultural one. So we couldn't raise as much money for that bit of the programme. And two, because the academics we had chosen proved to be a bit awkward and difficult because they couldn't get research students and stuff like that. […] And so not much happened on that front.
>
> **Q.** So it wasn't half of the money micro-organisms and half…
>
> **A.** No. We hoped it would be, but in fact as a result of these issues…one less interest in the companies, and also these issues in the academic world…then we didn't manage to get that off the ground as well… something happened in fact I wouldn't want you to pursue that because I can't remember what happened I'm afraid, but it certainly was much… a much smaller part of the programme than the agricultural side[47].

## *5.5 Conclusion*

From the picture drawn in this chapter, despite its small scale, it may be argued that the attitude of policymakers towards science and scientists' work may have created some problems in the overall debate. The situation described here is indeed a paradoxical one. On the one hand, there is a political establishment that needs to come to terms with the emerging regulatory developments in Europe. Science is used as a consensus creating mechanism in order to have a competitive and uniform regulatory regime in Europe. On the other hand, there is a political philosophy that wishes scientists to simply respond to policy objectives – that is, making research more oriented towards

[47] I would have liked to dig the issue further, but the interviewee request not to push towards that direction – even if it may not appear from the transcript – was quite strong. I thus preferred not to spoil the pleasant atmosphere we managed to establish during our conversation, especially considering that I had yet to ask some important questions.

industrial applications. The British government was expecting the views of the industrialists to bear more influence than the academics’ ones in the decision about the direction of scientific research. At the same time, industrialists were clearly quite reluctant to take this leading role, and actually defended and valued academic scientists’ autonomy, despite them being interested in influencing regulation too. The academic scientists are in the middle. They are in the double constraint of having to fight in order to make their voice heard and having to behave as an active economic agent, through their institutions, in order to protect their financial assets. The next chapters will try to identify the consequences of this very complicated situation. Again, PROSAMO will be used as an instrument to detect more general tendencies.

# Chapter 6 – Making Sense of Uncertainty through Professional Expertise

The documents examined so far – PROSAMO archive texts, interviews, scholarly work – allowed to draw a clear, although complicated, picture of the initial stages of the debate over the release of genetically modified organisms and of the role regulation has played in this debate. The very early documents of PROSAMO have shown that its industrial members, big multinational companies in the food and chemical business, were not simply interested in determining if releasing genetically altered organisms was safe. Actually, safety was a marginal concern for the experts involved, since there was a wide consensus within the scientific community about the harmlessness of modified crop plants. What can be easily argued is that the problem of safety is not related to the 'nature' of the released organisms, but to the kinds of people involved in genetic engineering work and their position within a structure of social relationships. This short chapter provides a brief summary of the general context in which PROSAMO was given birth and establishes an important connection between the previous chapters and the coming ones, where the subsequent stages of the PROSAMO initiative will be discussed.

## *6.1 Institutional relationships*

First of all, the importance of the historical background was discussed. Chapter 1 showed how in the 1970s recombinant DNA technology became very quickly a matter of concern for the scientists involved in this kind of work. According to Wright (1994) they had two, almost contrasting, concerns. Simplifying her discussion, they feared that the new technology would have made possible the creation in the laboratory of new organisms, the behaviour of which was even more difficult to predict than for already known and commonly used ones. At the same time, they feared that research in the area would have been compromised by wild and unjustified concerns, especially considering the fact that in the revolutionary nature of genetic engineering they foresaw new possibilities to solve existing problems. The production of insulin was one of the first examples of the great potential behind this new technology. Given this potential, many scientists could see in recombinant DNA technology a powerful justification for receiving both public and private funds in an era when accountability was starting to become a political requirement.

Biotechnology became even more important when researchers had to overcome the financial constraints placed by the Thatcher government, which significantly cut public expenses, including those earmarked for scientific research, during the 1980s. In such a context, universities and scientists moved towards new sources of funding, and biotechnology was one of these sources. On the one hand, they could attract private investments, given the great number of possible applications foreseen in various sectors; on the other hand, universities started to move within the logic of the market both as competitors and as business partners of more traditional industries. These dynamics appeared clearly when the setting up of PROSAMO was described. This initiative was seen as an opportunity for academic scientists to emphasise their expertise and offer it to industry or to the government. Scientists did this in a very strategic way, as they were clearly trying to figure out what 'GMO' or 'genetic engineering' could do for them. In a nutshell, scientists thought that organisms obtained through recombinant DNA technology were safe, but they were also able to identify good financial opportunities in playing along with the government and some major companies in treating these organisms as special. They could offer their professional expertise to solve others' problems, and achieve their objectives in this way as well, as seen when one scientist claimed that it would have been hard to receive the funding to develop an ecological experimental protocol if it were not for genetically engineered organisms being perceived as problematic (Chapter 5). From this point of view, and as already remarked in Chapter 4, experts really behaved as an epistemic community, working towards helping the relevant policy actors to define their interests in a technological area that had uncertain contours.

From a political viewpoint, the UK government's main concern was the modernisation of the country in a period of deep economic crisis. The government sought to preserve and increase the country's competitiveness through a policy that was explicitly supporting the most promising fields from a commercial point of view – fields that required high levels of scientific competence and investments. Biotechnology was one of these fields. The need to combine modernisation with the desire to cut public expenditure meant the implementation of policies that necessarily favoured multinational companies with significant financial capabilities.

The LINK programmes became the instrument to implement the modernisation aim. They were collaborative research programmes that were jointly funded on a 50-50 basis by industry and government. They were supposed to stimulate industrial investments in research and to facilitate the transfer of knowledge from the universities to the companies. PROSAMO was one of these collaborative research programmes, and it possessed many of the ingredients sought by the government: it contributed to the transfer of knowledge from the academic to the industrial setting; it pushed the private sector to meet part of the costs of the development of the new technology; it helped to build up relevant experience and qualified workforce in the new field of enquiry. All these were important aspects favouring the competitiveness of British industries.

Competitiveness was however thought to depend upon other fundamental factors. On the one hand, there needed to be a public willing to buy the new products produced through the exploitation of recombinant DNA technology. Public perception was thus an important matter if British industry was to thrive. On the other hand, regulation was important too. Through the DTI, the government was expressing concerns about the creation of a too restrictive European regulation, contrasting with the 'expected reality' of the safety of recombinant DNA-containing organisms. From this point of view, PROSAMO was an attempt to influence regulation, particularly at the European level, where some member states were more inclined to listen to the arguments of green parties and environmental lobbies. PROSAMO could influence regulation by providing a formal, authoritative assessment of the risk of releasing important modified crop plants into the environment. For the government, the scientificity of a project like PROSAMO was instrumental to the establishment of a consensus within the European Community – a consensus that would have led towards a homogeneous regulatory environment and thus the exploitation of a single, unified market.

Similar considerations hold for the industrial members involved in PROSAMO. As seen, some of the companies operating in the agrochemical business were trying to restore their image by adopting a reactive kind of regulation. This regulation was also functional to their business requirements. ICI, for example, saw in the new technology a risk of technology substitution and needed time to find synergies between chemistry and biotechnology. Also Unilever had an interest in precautionary regulation. Unilever was worried about the changes occurring in the food supply chain with the acquisitions of seed companies by chemical ones, and wanted to keep the developments of the technology under close scrutiny. A slow regulatory regime would have allowed easier monitoring. Monsanto was trying to avoid having its herbicide resistant crops banned from the European Union because of negative public perception. A precautionary kind of regulation was initially perceived as the best way to tackle the problem of public perception. In general terms, a reactive approach to regulation, the promotion of a case-by-case, step-by-step regulatory framework was considered a solution to these problems of public perception and competitiveness. Of course, the companies generally did not want a restrictive regulatory regime to go on ad infinitum and therefore needed the authority of science to be able to claim that GMOs were safe. It is easier to understand the role of PROSAMO at this point. Through PROSAMO as a scientific process, the participating companies were able to justify their favour and support towards a restrictive regulatory procedure that was aimed at reassuring the public and slowing down the development of the technology[48]. PROSAMO as a finished product could have then been used as an authoritative piece of science to justify the abandonment of the precautionary principle and the constitution of a simplified procedure to obtain the authorisation for releasing GMOs into the environment.

[48] We need to not lose sight of the fact that there were also powerful pressures towards the liberalisation of the technology. Small companies could have an interest in biotechnology; farmers did not dislike the idea of employing the modified seeds if this meant the use of fewer chemicals (see Tait, 2001); the European Union itself was interested in biotechnology for improving land use, as shown by the 1983 Communication of the Commission to the Council (COM (83) 500).

### 6.2 Uncertainty, Risk and the Social Standing of Science

It is now even easier to understand why in Chapter 3 it was argued that GMO as a category can be understood as a cultural object, as can PROSAMO as well. They are both objects that are formed as a coalition of needs and attitudes gets translated into a tangible set of practices or is put into words. Looking back at Chapter 1, it should be remembered that the 'genetic engineering' formula as a synonym for recombinant DNA became frequent in the popular domain only since the 1980s, particularly after 1985. 'Genetic engineering' treats the new GM products as something special and emphasises the need of professional experts to deal with the risks. The very naming of PROSAMO – *Planned Release of Selected and Manipulated* [later change to 'modified'] *Organisms* – is in line with this interpretation. "Planned release" makes implicit reference to a controlled environment under the management of reputable professional experts, whose expertise is invoked when talking about genetic engineering. It is true that the coupling of "selection" and "manipulation" implicitly establishes a homology between traditional ways of modifying genomes, like plant breeding, and recombinant DNA. But this homology has clearly to be unveiled progressively, for reasons mentioned already in Chapter 4. This could be justified by exploiting a readily available cultural resource – that is, the previous experience of the regulation of GMOs in a contained environment, where the new technology was treated as special because of the emphasis that relevant social agents were placing on its uncertain character. The language used in the two cases is indeed very similar. *Escape* is a concept used in both laboratory work and field releases. The field experiments, and the regulatory requirements, were designed to avoid or monitor the *escape*, or the transfer of genes from species to species, and to see the significance of it when and if the *escape* happened. In other words, the experiments and the work of 'genetic engineers' were designed to acknowledge and deal with the uncertainty that was clearly visible in documents like the 1986 letter from the Royal Commission on Environmental Pollution introduced at the end of Chapter 1.

Clearly, the context just outlined is quite far from the account of institutional behaviour presented in *Uncertain World* and discussed in detail in Chapter 2. The "over-confident body language" supposedly attributed by certain theorists of the risk society to dominant institutions does not do justice to the complex picture drawn in this and the previous chapters. These have demonstrated that, as predicted by Douglas, the institutional debate on the release of modified organisms is actually characterised by a very strategic use of and emphasis on the concept of uncertainty. From this point of view, uncertainty really needs to be conceived as a rhetoric tool through which major organisations and their affiliates pursued their many, different objectives. The strategic use of the precautionary principle – which emphasises the ubiquity of uncertainty – does not just contradict what is stated in UW, but becomes even more evident in a context in which GMOs were unanimously considered safe with regards to their environmental implications. It is clear that uncertainty becomes an instrument in the hands of dominant institutions to keep exercising control while dealing with a technology that could have serious repercussions in the established structure of power. What was said in the second chapter can thus be confirmed: that although everything is uncertain, some uncertainties are given more weight than others depending on the position people occupy within the social structure.

It is true that in the case of PROSAMO, and of the institutional debate about genetic engineering both in the UK and in Europe, it is possible to identify a veiled optimism in the way dominant institutions talk about risks. But whether this optimism can be branded "overconfident body language" is quite arbitrary. A deeper look at this optimism may actually provide some more interesting information.

### 6.2.2 Uncertainty and optimism: the positive role of scientists

A clear example of this optimism is found in the 1986 ECRAB paper (see Chapter 1), where a long discussion of the benefits of genetic engineering – increased yields, better nutritional values, better quality and more precise breeding methods – were opposed to a rather short reference to the purely conjectural nature of the risks, the assessment and management of which had to be under the control of professional experts. True, one could argue that the ECRAB's document should be interpreted as a form of lobbying exercise. After all, it was supposed to be a contribution to a wide discussion that saw the involvement of a great variety of social actors. Showing optimism was needed to have their support. As suggested by Douglas and Wildavsky (1982), “for or against the center, for or against market or hierarchy, the strongest attack rests on some positive ideals” (p.175). For the centre, the risks lie mainly in failing to achieve this positive ideal, its version of the good society, the promises of which “can be used for holding people in their roles and for blaming them if they weaken” (p. 176). From this point of view, the attitude of hierarchies is necessarily optimistic, because it is this optimism towards the promises of its positive vision that maintains the commitment of the subunits to the hierarchical structure itself and to the meaning it gives to reality. Hierarchies tend to continuously provide incentives to commitment, as seen in ECRAB’s strong and explicit call for “consensus”. This would indeed be a fair interpretation if this way of treating risk was exclusive to the public domain. But it is interesting to notice that even within the walls of the organisations involved, in documents that were not meant to be read by external eyes but just by a restricted group of people, it is possible to find a similar optimistic attitude towards genetic engineering. Sprott’s and Hughes’ document (discussed already in Chapter 4), which was not simply internal to PROSAMO, but actually only accessible to few people within Unilever, is paradigmatic from this viewpoint. In the document, itis easy to identify the pervasive optimism in the discussion of the risks of “rDNA containing organisms”.

The document itself actually starts with an account of Unilever’s possible business opportunities opened up by biotechnology, particularly rDNA technology. Although the explicit focus of the documents is on risk, very little is said about what these risks could be. The document mainly focuses on the environmental impact of GMOs, rather than on risks or on the possibility of damage. Damage is only contemplated for accidental releases, because planned release of dangerous organisms is not in the agenda. The following quote from the document is quite revealing:

> ii. <u>Environmental Impact</u>
>
> The major factors determining the environmental impact of a released organisms are:

(a) Colonisation – the likelihood that the organisms will become established, and will reproduce in the wild. The factors involved are related to adaptation and successful competition in the ecological sense.

(b) Damage – the probability that direct damage might result to individuals or the ecosystem without the need for reproduction or colonisation. This will be a function of the scale of the release [or escape] and the potential for damage that the organism has.

(c) Introgression – the probability that genetic material, including the recombinant DNA of the invading organism could be transferred and incorporated in the genome of wild organisms in the environment. This will depend on the degree of reproductive isolation possessed by the organism and the stability of the recombinant DNA it contains.

(p. 4-5)

> The relative prominence of these factors will depend on whether one discusses accidental or planned release. Thus, "damage" is really only of significance to accidental release, since deliberate release of organisms with a potential for damage would not be contemplated.

As to planned releases, Hughes and Sprott talk about the risk of introgression, which becomes a risky factor only within specific environments:

> For example the release of rDNA containing oil palm in Malaysia where there are no wild relatives would be subject to less concern and therefore constraint that release in West Africa. (p.7)

It is a matter of commercial and scientific (moral) integrity to provide proper isolation. The latter kind of integrity is implicit when it is said that the release of potentially damaging organisms is not considered. Commercial integrity is explicit in the following paragraph:

> Fortunately the history of selective breeding of crop plants has already resulted in a high degree of isolation. Furthermore, it is profoundly against the commercial interests of any agency proposing to release an

> rDNA crop plant that "its state of the art" rDNA component should introgress into wild or related cultivated species. Thus we expect that scientists will do their utmost to exploit systems of controlled fertility and incompatibility to ensure genetic isolation of their rDNA organisms. Further we conclude that there will not be enduring technical reasons for withholding clearance for release of rDNA containing plants. (p. 7)

The last sentence of the previous quote further confirms the optimistic attitude of Hughes and Sprott, and of their organisation more generally, in respect to the technical difficulties surrounding plant genomics. This attitude is the replication of a previous comment on page 2, where the authors claim that "safety and clearance problems in the former [in a rational risk assessment] will become rapidly resolved by technological safeguards".

All this seems to suggest that although risks are contemplated, these risks are only marginally defined. Actually, their definition intermingles with implicit rules of proper ethical, commercial and scientific behaviour. Instead, a strong and explicit positive view is put forward in terms of benefits and of possibility to overcome safety issues through technical development. Such an optimistic attitude is not just instrumental to keep people committed, it also reflects the high status possessed by science and its professionals. What we have here is an implicit vision of a good society determined by a moral science. This attitude was confirmed by one of my industrial interviewees from Unilever (U1), who warned me against placing commercial interests above the sense of morality of scientists, and by one of the academic scientists participating in PROSAMO, who conceded that you could do "very mischievous things" with rDNA technology, but that "we [the scientists] were not going to do them". The high social standing of science and morality are a very strong combination.

## *6.3 Conclusion*

To conclude this chapter, it is very easy to identify numerous descriptions of the potential benefits of the technology within the discourse of the dominant institutions. But it is quite arbitrary to label these descriptions as overconfident, especially considering that most of the times they are explicitly offered as speculations rather than predictions. Besides, this optimistic attitude is surrounded by discourses emphasising uncertainty[49]. Thus, if at the beginning of the thesis it was claimed that the explanatory model adopted in *Uncertain World* to account for the general negative attitude of the public towards GMOs is quite untenable from a theoretical point of view, there is now empirical evidence for its inadequacy. An alternative approach, linked to Mary Douglas' work, has been proposed. The perception and definition of risks (and uncertainty) is the expression of pragmatic interests associated with an established or desired way of living. These interests depend on the position people occupy within the social structure and every opportunity to exercise or evade control will be exploited to further them. Recombinant DNA technology represented a potential shift in the structure of authority. A new category was therefore created by the dominant institutions, *genetically engineered organisms* (as they were called at the time). They attributed a special status to this new kind of objects, and then they aimed at maintaining their power base by absorbing that category in routine activities (like plant breeding). PROSAMO is only a part of the history of this process of creation and management of the new category, although a significant one. It shows that the UK government, particularly through the DTI, some major British/European companies and a diversified academic community closely interacted and negotiated what should done with and about GMOs. The analysis showed that within this interaction, what mattered were not just GMOs, but the social standing of science as an institution and the social standing of its practitioners. It is to this topic that the discussion will now turn.

[49] At this point, one may actually be tempted to think that the negative attitude towards GMOs may have been caused by an ambivalent institutional attitude towards these new entities, rather than by an overconfident body language. On the one hand, the dominant institutions have shown optimism, but they have at the same time emphasised uncertainty. This may have fuelled suspicion, although we constantly experience situations in which we need to face uncertainty but we are fairly confident that we will be able to manage what is going to happen. A new job in a different city or country without much confidence with the language can hide plenty of uncertainties, but the very fact that one has applied for the job and accepted an offer shows a lot of optimism.

# Chapter 7 – Science at Stake: ACRE and the Move to a Statute Based Regulation

So far, this work has analysed GMOs and PROSAMO in an almost synchronic way. It basically described how they, as cultural objects, came to be and what they were intended for in relation to a system of different organizational interests. However, both GMOs and PROSAMO are objects the shape and meaning of which needed to be maintained over a given period of time through constant effort. Therefore, accounting for PROSAMO's inception is not enough. What needs to be done at this point is to look at how PROSAMO developed over time in relation to its intended purposes. What happened after PROSAMO started? Did it help the social agents involved to achieve their objectives? Did regulation relax after PROSAMO was complete? Was the GM category abandoned? Did the organizations involved manage to reassure the public? Clearly, given the quite negative public opinion that has emerged since the beginning of the '90s and the fairly restrictive regulatory position adopted in Europe and still holding, it is hard to describe PROSAMO as a successful initiative. That something significant happened was already visible from the slow but clear shift from *genetic engineering* to *genetic modification* – a transition that started in the 1990. What is it that fuelled this transition? What kind of social dynamics does it represent? How is PROSAMO going to help in identifying them? The answers to these questions will be developed over the next three chapters.

This chapter in particular focuses on the effects of important political changes on the role of science in decision making. Section 7.1 offers a general discussion of the changing role of experts as PROSAMO moved into the 1990s. It is recalled that scientists lamented a loss of social standing in a political environment in which science could play only a marginal role. It is argued however that this problem could not emerge as a result of the government's science policies – or at least not just because of them. Section 7.2 and 7.3 explain that this sense of loss of social standing coincides with the bureaucratization of GMOs following the approval of European Directive 90/220 and with the move from a voluntary to a statutory based regulation. Section 7.4 shows that the bureaucratization of GMOs should not be interpreted as a direct consequence of regulation, but rather as the result of a power struggle to make a given interpretation of regulation the dominant one. From this point of view, it will be clear that regulation is not the explanation of what happened, but rather part of what needs to be explained.

## *7.1 The Changing Role of Expertise: Scientists' frustration*

An important diachronic element that one of the previous chapters (Chapter 5) has highlighted is the sense of frustration that academic scientists developed over time and that was associated with a strong idea of lost social standing. This sense of frustration has been expressed in a variety of ways and quite explicitly by one of the academic researchers working in PROSAMO, and it had something to do with the bureaucratic nature of the project. The interviewee claimed that there was a lot of interest within academia for this project, and a lot of competition, maybe a sign of the positive expectations scientists had about a partnership with the private sector. It was clear, however, that in due course these expectations changed quite significantly. It also became evident that the main target of this frustration was the "government", the "politicians" or the "bureaucrats". Not that industry was completely discharged, but the relationship between scientists and industry was strikingly much more positively described than the relationship between scientists and government officials. The bureaucratic nature of the project was associated with the involvement of the government. It is worth reproducing here one of the quotes reported in Chapter 5:

> **Q**: The bureaucratic thing was then related to governmental involvement?
>
> **A**: Exactly. It was the government perception. […] in 1988 some bureaucrats decided that GM had to be treated differently. And that was the seeds of all problems. Therefore it became a bureaucratic issue, the precautionary principle was introduced. I'm sure you've heard a lot about that. It's absolute bullocks scientifically, but it sounds good for a politician to be able to say.

It has already been seen that the support for the precautionary principle initially came form the industry rather than from the government. It is very interesting to see that this process is now described very differently by the very people who were involved in these dynamics. It is possible that because many years have passed, the details of the events got rather blurry. It is however the case that some government organisms, especially the Department of the Environment and the Royal Commission on Environmental Pollution, beginning in 1989, started endorsing quite strongly the precautionary principle. The 13th report of the Royal Commission on Environmental Pollution (1989) explicitly called for a precautionary approach for dealing with genetic engineering (see Levidow, 1994). So A1 may have referred to those later events, which did indeed play a relevant role, as explained later. But I would like to return to the fact that the government is blamed for things going wrong, as this will help the argument move towards the most plausible interpretation of this sense of frustration.

### 7.1.1 The role of the Government

I thought at first that this anger towards the government was due to the government's approach to science. It should be remembered that behind government's science policy there was the rationale that industrial control over research would have resulted in more readily and commercially useful discoveries. One could see this logic at work when Chapter 5 discussed Coleman's (1989) contribution to the debate on the relationship between science, technology, industry, regulation and competitiveness. He claimed that scientists were to be kept under control by decreasing the importance of the peer review process and by handing the responsibility of sorting out relevant priorities in research to research managers (see Chapter 5).

On that occasion, Coleman implicitly drew an interesting picture of the relationship between science and technology. As one scholar argued (Barnes, 1982), there has been, traditionally, the tendency to describe the relationship between science and technology as a hierarchical one, in which technology had the intended aim of deducing the implications of science and realise them by giving them a physical appearance. In other words, scientific theories were thought to lead almost inevitably towards certain technological developments. Barnes also argued that by the time he was writing, this view of science and technology was undergoing a significant change. That is to say, science and technology were starting to be interpreted as two forms of culture that can establish a relationship of mutual support. For Barnes this is the right way to look at technology[50].

From a political and economic point of view however, at least in Coleman, the cultural freedom of technology from science meant that technology could and did become the direct focus of policymaking, and that only that science that was useful for supporting and maybe speeding up technological development should be considered for state funding.

In Coleman there is also an implicit vision of what technology is. When he talks about industrialists being more important than scientists, he is referring to technology not simply as a solution to a problem, but as a solution to a commercial problem – that is, something that can have, in a variety of ways, a direct and positive impact on the market. A piece of technology can be sold in the market, or through technology one can produce new products that can be sold in the market, or can make the same products with fewer inputs (resources, labour or energy).

For Coleman then, science does not only lose its precedence in its relationship with technology, but it actually becomes subservient to technology exclusively interpreted as an instrument for market competitiveness. Thus I initially thought that this could have had an impact on the self-esteem of the scientists, who therefore felt frustration and resignation. It is reasonable to assume that scientists changed their perception of themselves, but whether this perception became more negative is another matter and difficult to say. From what has been learned in the previous chapters, scientists really adapted their own image by presenting themselves as technologists, as the terms “genetic

[50] For an interesting account of the relationship between science and technology see Price (1969) and Layton (1977).

engineering" indicated. The next section will try to see what could have most likely decreased scientists' self-esteem.

### 7.1.2 Scientists prestige and the private sector

It is not difficult to argue that the commercial orientation given to science policy by the government of Margaret Thatcher may have injured the prestige of the scientific community – if we consider it as a status group (Weber, 1978). Calvert's thesis (2002) is quite interesting from this point of view, as it shows that indeed the utilitarian approach towards science did cause harsh reactions within the scientific community and pushed scientists towards 'boundary work' activities (on boundary work see Gieryn, 1983, 1995 and 1999). In other words, scientists engaged in "tailoring work" (Calver, 2002:225) to make their research appear useful to policy makers. The privatization of the Plant Breeding Institute, for example, was criticised by many of the scientists involved in plant breeding work. Ralph Riley, in the foreword of *Wheat Breeding* (Lupton, 1987), comments on the decision of the government to sell parts of the activities of the Institute in the following way:

> This book may have to stand as a memorial to the 'Cambridge School of Wheat Scientists' [...]. This is because the United Kingdom Government has decided to devide the institute, and so the School, into two – selling the applied activities to private enterprise while retaining in the public sector research that is not yet applied. In this casual way one of the great successes for all time in crop research could be destroyed. Whether either of the separated parts can long survive is unclear; certainly the strength of mutual support will be lost or will have to be rebuilt.

It remains to be seen, however if the moves of the government, which stimulated such strong verbal reactions among scientists, did actually have a significant impact on scientists' self esteem and source of prestige. Calvert (2002) is of the opinion that it did not:

> One of the most important features of scientists' behaviour in respect to basic research which emerged from my interviews was the 'tailoring' work that scientists engaged in to make their work appear more applied when they perceived this was necessary (section 7.4.1). As one scientist described it, this involved 'squeezing' research into available programmes to make it fit (Chapter 7, section 7.4.2). These scientists denied that this had any effects on their own research. I associated this tailoring with the 'idealising of basic research discussed above because, by denying that their tailoring is having any impact on their basic research, scientists could still retain their 'idealised image of untainted basic research, while also managing to acquire resources in a funding context which demands applicability.
>
> I argued that tailoring should not be seen as deceitful [...] but that it may be necessary for scientists to retain their self-image. (pp. 225-226)

According to Weber, prestige is frequently associated with a parallel process of monopolisation of ideal and material goods. Because prestige depends on this exclusive possession, status groups will often tend to monopolise resources that will not be easily bought by money. The prestige of the scientific community is associated with the monopoly on the production of credible scientific information. This monopoly, as suggested by Barnes (1985) is related to the powerful mechanisms of control over recognition available to science as an institution. Barnes claims that scientists "tend to be particularly concerned to obtain recognition from their fellow scientists, and attach considerable importance to signs of that recognition, such as approving citations, formal honours, awards and prizes. The publication of one's research results is an accepted way of obtaining recognition. [...] Thus, recognition serves as an incentive and reward for the execution and publication of original and significant research" (p. 45).

But recognition "is implicated in the system in a much deeper, more fundamental way" (p. 45) than the simple desire to make a good impression. Everybody in most circumstances `wants to make a good impression. "The routine procedures of the scientific community are laid down in such a way that recognition is the route to all things" (p. 45). Recognition, according to Barnes, is the currency that give scientists access to a whole range of scientific and material rewards and that remains under the control of the scientific community[51]. This control over recognition allows scientists to remain independent and to ultimately keep their authority. Barnes argues that "if the power of money could reach directly into the core of scientific research and systematically condition scientific judgement, the scientific community would be thoroughly corrupted and its standing and authority would decline" (p. 48). My question is: did the government's utilitarian approach and its financial cuts to research activity affect the monopoly of the scientific community over the creation of credible and authoritative information? I am sceptical about this. First, the very fact that PROSAMO was conceived in order to exploit the authority and prestige of science by policy-makers shows that the status of science was not questioned in governmental circles[52]. Second, biotechnology was one of the scientific fields that suffered the least from Thatcher's science policy.

True, one may argue that the government's approach increased scientists' dependence upon private funding. One might question, however, how much this shift had something to do with scientists' feeling that they had lost social standing[53]. The following quote from S1 may help a little our interpretative work:

> That [the plant programme] was a very immediate programme and these guys [from the PROSAMO brochure, Mike Crawley and Philip Dale] tackled this: good reputation, lots of information, lots of academic respect.

[51] It is important to give credit to Robert K. Merton for his emphasis upon the reward system at work in science. See Merton (1957, 1973). See also Glaser (1964), Crane (1965) and Cole and Cole (1967) on the different ways recognition is distributed. Further discussion can be found in Ziman (1968).

[52] On the importance of displaying authoritative knowledge in policy making see also Hilgartner (2000), where the author, by using Goffman's 'dramaturgical model' (Goffman, 1959), analyses how the credibility of science is created and displayed.

[53] I want to emphasise that when I talk about scientists, I always refer to scientists working in the field of genetic engineering, and in particular to scientists involved in work in agriculture.

This researcher makes quite clear that in the new context science needs industry's support at least as much as industry needs the support of science as an independent institution. And indeed, as seen, the companies are quite praised for their handling of academic independence in the context of PROSAMO. The point is that even more than governments, companies need to deal with the institutional character of science, with its embedded system of distribution of recognition and credibility, in order to make their activity a profitable one. Actually, companies tend to be active players in the reproduction of science as an institution – that is, as an activity that is "routinized, counted upon and planned around" (Barnes, 1985, p.11)

The application of standardised procedures increases the effectiveness of science, because "error prone individuals systematically organised and coupled together in their professional activities make a highly reliable, far less error prone, knowledge producing machine. Given the centrality of knowledge for the activity of most technology oriented firms, it should not sound surprising that they want to be an active player in this knowledge producing system. For example, Hicks et al. (1996) show how large European and Japanese firms publish a considerable number of contributions in the scientific literature. As Hicks (1995) points out, "some companies are among the most highly cited institutions, indicating that their work is of high scientific standard".

But it is important to bear in mind at this point that the "high scientific standard" character cannot be self-attributed. It is instead the result of a process that follows a pattern of collective definition and evaluation where recognition and credibility play major roles. This is important if one considers, for example, that work of high scientific standard is a useful tool, in the hands of a company, for regulatory purposes, given that regulation affects the modes and possibilities of profit making in a given sector. PROSAMO, as has been seen, was meant to represent a high-standard science-base that should have been used to prepare the regulation of the release of GMOs into the environment. But this science base could only be effective with a hallmark of quality that is only granted to scientific work going through publication. The publishing system functions as a quality control mechanism. Research that is deemed to be of high quality will get a hallmark of quality which is translated in the form of recognition for the scientist. The scientist has the incentive to produce the best work possible because ultimately, it is his honour and credibility at stake. As seen already, publishing is the route for recognition of high standard work, and this recognition will then grant access to other resources, grants or well paid posts. More importantly, relying on reputable scientists, who are allowed to build up their reputation, will mean for a company the possibility to get access to scientific networks and to exploit their advantages.

To summarise, companies want to make a profit and science helps them to achieve their purpose. The best scientists, who can guarantee high quality work and access to scientific networks, are those who have been judged reputable by the scientific community. Recognition has been attributed to individuals and gained by individuals by making their work public through publications. Reputation will be maintained if scientists are allowed to keep participating in the working of science as an institutionalised activity. In turn, this participation guarantees high quality work and access to other valuable resources for the companies that hire reputable scientists. It is easier to understand at this point why companies often leave scientists quite independent and value science as an independent institution.

### 7.1.3 Science as an institution

In the context outlined above, science is still an institutionalised activity that heavily relies on the peer review system, and for a variety of reasons. Through publications, scientists learn who is credible and with whom it is worth exchanging information. Besides, publications and documents in general often become the focal point for internal discussions within a laboratory. Latour and Woolgar (1989) state:

> We take formal communication to refer to highly structured and stylised reports epitomised by the published journal article. Almost without exception, every discussion and brief exchange observed in the laboratory centred around one or more items in the published literature.

> In other words, informal exchanges invariably focused on the substance of formal communication. (p. 52)

This focus on the published literature provides, in the interpretation of Latour and Woolgar, legitimacy to much of the informal communication going on in the laboratory. This seems to show that science as an institution is far from being jeopardised by the way science is treated in the commercial and political context and that there is plenty of scope for scientists to retain their social standing, given that they have the monopoly over the creation of credible and authoritative information, credibility that is deemed necessary for other institutions as support for their claims.

From our discussion so far, it is doubtful that science's importance has been underplayed in the new political context. If what has been said so far is not enough, one should simply look at the Royal Society 1985 *The Public Understanding of Science*, which explicitly stressed the role of science, and scientific literacy, for the wider society. The Royal Society's publication placed emphasis on the collective benefits of scientific literacy. Scientific literacy meant a better trained workforce and a public that was sympathetic to science as a tool for economic development rather than hostile (Bucchi, 2003: 812). True, it is noticeable that even for the Royal Society commercial concerns are quite important. The Royal Society is talking here about a science with economic spin-offs, a science with certain implications for technological, and therefore commercial, development. It is not talking about 'science for its own sake', but about science justified because of its commercial implications. Calvert (2002) claims that:

> [...] justifications based on economic benefits are those which are almost exclusively drawn on by governments in both the countries [UK and US] I am examining in my empirical work. For example, the UK Department of Trade and Industry (1998) has as an unaddressed presupposition in their whole approach that basic research is only worth doing if it can be commercially exploited by being transformed into *innovations*. (pp. 79-80)

But Chapter 5 illustrated that because of these utilitarian concerns academic scientists were becoming active economic players, at least initially. Towards the middle of the 1980s university departments were starting to pay a lot of attention to intellectual property rights as a possible source of money, given the government's cuts. So it seems that academic scientists, through their organisations, were involved in hard negotiations with industry and government and that there was actually little deference towards the sponsors[54].

### 7.1.4 Science as a transversal culture

Actually, what my material clearly emphasises is that the scientific culture cuts through the various institutional realities, so that there is a strong sense of identity among scientists from different institutional backgrounds. Emphasis on this shared culture is frequently stressed by the interviewees. A Unilever researcher, when asked if there had been problems during the experimentation period, claimed that at that point, after the lawyers were gone and the managers were gone, the industrial and academic scientists got along well together. Comments like "you know, we were all scientists" or "companies' scientists were formerly employed by universities" or "we all knew each other" are recurrent themes in most of my interviews.

[54] There are other, different accounts of the relationships between science and society and the nature of scientific research (Gibbons *et al*, 1994; Ziman, 1994; Etzkowitz and Leydesdorff, 2000). The Triple Helix approach, just to take an example, states that the university-industry-government relationship is changing in contemporary knowledge-based societies and that "increasing competition for research funds among new and old actors has caused an incipient breakdown of 'peer review', a system that could best adjudicate within a moderate level of competition" (Etzkowitz and Leydesdorff, 2000:117). Whether this is the case, I am not sure. It is interesting to explore recent examples of research funding in the UK. The National Institute of Health Research (NIHR) is a funding body under the aegis of the Department of Health established in 2006. Many research programmes in NIHR give money for applied research. Research applications need to have a clear orientation towards concrete applicability. The Research for Patient Benefit Programme (RfPB) for example, requires applicants to explicitly explain how research results will be used to improve people's health or their experience of the health system. All research applications that get through the first stage of acceptance are peer reviewed. Of course, one may have doubts about how the peer reviewers are selected. Well there is nothing outrageous about it, really. I have been recently interviewed for a job position in the RfPB programme, and the interviewers asked me how I would select the peer reviewers. I answered that I would probably talk to people I know that have worked on the subject in question or that may know people working on that subject. Then I asked if they had other procedures, and they frankly told me that they use Google a lot to find potential reviewers. What the programme managers search for in Google are specialists that clearly have qualifications and academic reputation – that is, credible individuals that can better evaluate the quality of the research proposals. Science as an institution based on recognition and peer review is at work here to minimise the chances that poor quality work will be funded.

### 7.1.5 Scientists' expertise and regulation

In addition, the PROSAMO material – archive and interviews – also explicitly shows the significant role that their expertise played in regulation at the time. S1, for example, said that "the Department of Environment and the Department of Trade in the UK [...] very much would elicit comments from the UK scientists and UK industrialists basically, so that we were all involved...I think a number of us were involved in EC meeting as experts". Both the Unilever interviewees stressed their involvement as experts in meetings with government or EEC officials. Beringer stressed the fact that industrialists in supervisory bodies like IISC first and ACRE later were appointed because they were good scientists. He said that industrial appointees

> don't have any more power than any other member on the committee. The only power they have is the one related to their expertise. And if they're good, then they can have a big impact. If they are not good they have a negative impact. And they always start with the disadvantage that they are thought to be representing the industrial needs.

Thus, it is clear that well within the Thatcher experience, scientists' social role is far from being irrelevant. In this context, it is worth reporting the vent one of the ICI interviewees gave to his frustration, which shows that science used to be important up until 1990, when the European Directive EC 90/220 was passed by the European parliament and expertise lost its relevance in the regulatory debate:

> I think the UK regulation came out first. The UK regulation was pretty good actually. The Dutch regulation was pretty good. Then we had to have European regulation obviously. I think they were very political. And I think people in DG XI at that time were very political as well, and they weren't that interested in actually the science basis. They were trying very hard for a political agenda. And again you have to think what, how Europe was in that period, in 1990 when regulation came out. And I think the European Commission was, at the time, was going through a very political phase. It is less political now.

> […]
>
> The Commission was out of date of what was going on. We saw a lot of decisions were taken not on science but on politics and on other agendas. And we still do.
>
> […]
>
> We just said we are right, we ban it. And a lot of that had to do with politics and commercial. […] I think Europe should be ashamed with the way it behaved. There was no scientific evidence at all. There is no scientific evidence for the European position to support.

This is echoed by S1, who complained about European regulation not being "incredibly informed scientifically". But when these scientists complain about regulation not being scientifically informed or about the European Commission being "very political", what are they actually complaining about?

The interviews leave little doubt about the fact that it is the professional expertise, the fact of belonging to the institution of science, and the high status that is conferred to this expertise that seems to be at stake when scientists express frustration. When they complain about things going wrong, about things becoming political, it has become clear that these scientists are actually complaining about a perceived loss of their standing as scientific experts, especially when compared to the most recent past in biotechnology regulation, when scientists successfully managed to monopolise the debate around risks of contained work on GMOs. Where to look then for an explanation of this perceived loss of social standing[55]?

The ICI informant's complaint points our attention towards European Directive EC 90/220, the directive that was passed in 1990 by the European Parliament and that was meant to regulate the release of genetically modified organisms. This regulation was perceived by many of the relevant social actors both in the UK and in Europe, and particularly by some large multinational companies, as

[55] Some have argued that the loss of standing and credibility of the scientists can be associated to disagreement among scientists. Disagreement among experts certainly does not help, but this seems to be hardly the case, at least when PROSAMO got started. Quite to the contrary, we saw that GMOs and their release were considered safe almost unanimously within the scientific community, including among ecologists.

being too restrictive. After its approval, industry started to campaign very strongly against it (see Levidow, 1994).

## *7.2 The role of science in the European regulation on the release of GMOs*

Comparing the dates, one would realise that the European directive was passed significantly before the end of the experiments undertaken under the PROSAMO initiative. PROSAMO started in 1989, although it was initially conceived in 1986. The experiments ended in 1992, after the European directive was implemented by various European countries, including the UK. Thus, the scientific information that PROSAMO was supposed to provide did not feed back into the regulatory debate. From this point of view, one of the primary objectives behind this initiative failed to materialise. One of my interviewee showed some disappointment about this. U2 said that regulation came out too early and that at that point different company cultures became more relevant. Before regulation, all the companies had a more or less shared understanding of how regulation should have been and how the science should have been used. Through scientific advice, companies wanted to justify the relaxation of controls. When this objective was not achieved, the only remaining objective was the creation of public acceptance for the new technology. At this point, according to U2, the companies working on a business to business basis like ICI or Shell lost interest in PROSAMO. Companies like Unilever, on the contrary, who were working in a business to consumer environment, tried to keep the project going because they realised that public perception was still an important objective. To translate this argument in terms of cultural objects, it could be said that PROSAMO was not able to keep together the system of interests and attitudes that had developed around it.

A confirmation of this changed attitude towards PROSAMO was given to me by I1. When asked why, at an advanced stage into the development of the project, he left the project and was assigned to other duties, he answered that PROSAMO "did not provide ammunition" in the European context, which he described as highly political (see above). So it would seem that because regulation "which is not incredibly informed scientifically" came out too early, scientific information did not have the possibility to frame the regulatory landscape. This may look like a reasonable explanation at first, but there actually are some problems. First, one should wonder hoq such a restrictive regulation could pass despite the favourable position scientists were covering as policy advisers. If scientists were generally favourable to GMOs, and they were quite influential in the policymaking arena, why did regulation end up being so strict? This regulatory outcome is even more significant considering that scientists had the support of DGXII, which campaigned against DG XI for a product-based legislation, and of the powerful industrial lobby. When asked about this, my interviewee gave various explanations. U2 said, for example, that it was almost an inevitable outcome. Many of the European countries, I was told, were quite inexperienced in genetic engineering and therefore countries that were "ahead of the game" (U2) like the UK had to compromise. According to U2, this sort of compromise moved the UK back five years. This would partly explain the frustration of UK scientists. After all the work done to progressively relax oversight on GM work, they found themselves "back in time" with their work having little impact on policymaking. But this contrasts with the picture of an expert-based, European-wide policy arena drawn earlier. In my opinion, U2's account reveals only part of the story.

### 7.2.1 Lack of information and Directive 90/220

It is true that many European countries lacked the expert-based safety regulatory experience of the UK. But it also is true that science is not an exclusively national enterprise. On the contrary, as Douglas points out, science and its language, because of its abstractness, could have easily contributed to the creation of a European union, of a shared sense of identity that could go beyond the national interests. The problem, however, was that there was no scientific information available upon which to build a formal agreement. This lack of information on risk assessment, a gap that PROSAMO members were hoping to bridge, had a long history. Since the debate on the contained use of GMOs in the 1970s, risk assessment experiments were not among scientists' priorities. Things did not change significantly for the release debate, not even when PROSAMO was conceived. Cantley recalls that at the beginning of the 1980s, only a very small portion of the European funding for biotechnology research was dedicated to risk assessment purposes (see Chapter 1). And PROSAMO, which formally started in 1989, had been for a long time the only project explicitly undertaking experiments for risk assessment purposes. This lack of interest, although widespread within the European Community, was probably even more salient among UK scientists, who had to live with Thatcher's cuts. So while UK scientists were leading experts in Europe on recombinant DNA technology, they may have played a small role in the risk debate considering that they lacked relevant information on the topic. There was already little money available for doing research, why should they have bothered to do risk assessment experiments for something that was perceived to be safe? Chapter 1 has reported the difficulty Beringer found in convincing fellow scientists of the importance of getting involved with safety regulation. The following quote from I2 on PROSAMO summarises well the attitude of scientists on the release issue:

In that sense it [PROSAMO] did not tell you anything very interesting in the end. It was not a very interesting result, but an expected result [...] So in that sense it was a lot of money to prove something which was not very surprising, which is fine, but in that sense it wasn't very satisfying as a piece of science. It was trying to rule out something which was pretty obvious. You could have said it before, but there was no reference so you just have to do this work and pay the money at this big project to show at least that there was some data out there.

Thus, UK scientists were not very interested in risk assessment experiments and the structure of funding was not an incentive to undertake them. PROSAMO was the only initiative of this kind. It was a big and expensive project, probably well known by all the relevant scientists involved in releases into the environment, and it is likely that they were placing a lot of expectations on it. This may be another reason for not being particularly interested in risk assessment experiments, since there was an important project already on its way. But it took a lot of time for PROSAMO to start because of some prolonged internal discussions which, according to U2, "delayed the start of project of at least 18 months". Because of this delay, scientists did not have at their disposal any scientific information, one of the most important elements through which their prestige and influence is exercised. This is very different from saying that they already lacked social standing when Directive 90/220 was approved.

### 7.2.2 The nature of ACRE

Although scientists may not have had the opportunity to jump authoritatively into the debate with hard information obtained through processes in which they are legitimately competent, one should wonder why, given that scientists were so frequently asked to give advice at both a national and European level, they could not have an impact on the modification of European legislation, or at least on its implementation. There are no logical reasons to exclude that scientists could have had an impact after the 90/220/EEC was approved. From this point of view then, the approval of regulation that is not considered scientifically informed cannot explain the fact that scientists start to feel that their position within society has been downgraded. I am not suggesting that the directive has nothing to do with it. On the contrary, it has everything to do with it, given that my interviewees almost inevitably connected their frustration with the approval of the EC 90/220. But I argue that the focus should be on something different than its scientifically uninformed nature. More specifically, the focus should be on the fact that the directive established that each European country should have nominated a statutory committee overseeing the applications for releases into the environment. The hypothesis is that in the UK this movement made the expertise of scientists, which was so valued until that point and that constituted their prestige as a status group, irrelevant.

### 7.2.3 ACRE as a network

Indeed, the most significant change that many of my interviewees have remarked upon is the fact that ACRE, the committee in charge of supervising intentional releases, became a statutory committee. If we were to identify a theme here, it could be said that “loss of information” is the most significant one. This is what Beringer told me when asked to describe his impressions when ACRE became a statutory committee:

> **B**: Let’s get these dates right. 1984 we had the first committee.

**Q**: The first committee on the release?

**B**: It wasn't a legal requirement until much later, if that's what you mean. And that's quite important. Because actually things got worse when it became a legal requirement.

**Q**: What do you mean?

**B**: People were less willing to share information. We found it more difficult dealing with people when there was a legal framework than when it was voluntary.

**Q**: Do you know why this happened? Why was that more difficult?

**B**: Partly because I think people resented the fact that it was thought the law had to come in when previously they could just say what they were doing and they were trusted…as soon as someone says basically "you are not trusted" then I think part of the human emotions is to say well, if that's what you think (then you probably better not trust me)…I don't know, it was just very interesting, the interaction changed.

**Q**: But I mean, the people were…were there…

**B**: People were less forthcoming. They gave you what you asked for whereas before there was much more flexibility and you could exploit it. And you've got to remember, as soon as it is a legal requirement you must not ask for anything that isn't legally required.

**Q**: You must not?

**B**: No because you have no right to ask somebody for something which they don't legally have to give you. So it reduces what you can do. While when it was a voluntary scheme you could ask any question you like nobody can say "you can't ask me"…It is a very interesting dynamic. So you could talk to people "where is your experiment going, how do you think it might go, what are the implications?" Whereas legally you couldn't do that.

Beringer thus emphasises the difficulties met by ACRE in getting information once it became a statutory body. U2 made very similar considerations:

The only thing I always said I thought actually made our system a little worse was that the regulations specified that you had to have a committee to oversee the experiments, to approve them. So the ACRE

> committee, instead of being an advisory committee, a real one, became a statutory committee on the law. Once it did that, and I was still a member, I was re-elected as a member, what happened was when we were sort of very much open in advisory, researchers would come in, present the project and I remember in one occasion we said this is fine as a research project but you will never be allowed to do this commercially, so don't even think about it. Because it's a nonsense. I think it was something to do with antibiotic resistance markers. Because I said, look, coming from the food industry, if you had this going through, don't do it because nobody would, we as Unilever would not want to buy it to sell it on, because of the sort of perception issue, not because of the safety issue, we didn't even know if there was one. But don't bother doing it beyond research level because commercially nobody will want to buy it. Now I remember having that debate. I can't remember which group it was. I think an academic group. You can actually do this, we did actually have real debates at a high scientific and technical level with people putting forward the projects. Now when we became a statutory committee, you were there to approve or not approve the project proposal in front of you. And all that debate and stuff disappeared because you couldn't do that. You weren't there than to say "have you talked to John Blox at the university of…because he has got some nice work on this and you might…". You had to approve or not approve this particular project, or aspects of it, so the sort of discursive part that was in ACRE disappeared. I don't know if the other members of the committee felt it. I certainly did. I think it was a loss actually, I think it would have been more useful to be able to have that real discursive nature.

It is clear that the interviewee interpreted the committee before it became a statutory requirement as a sort of networking hotspot. U2 inferred that there was a mutual interest within the larger institutional community (industry, policymaking and academia) to maintain this hotspot because it was seen as a useful and beneficial system for exchanging and bargaining. For example, companies' members were able to remain up to date with the academic research front and to exchange relevant information with prominent scientists.

Academic scientists were able to foster their network of contacts and to spot which the most promising areas were where one could get funding. Policy makers could be seen as being attentive to the safety of people and the environment. A committee like ACRE was therefore like a terminal where passengers to and from different locations, but with a common interest, could meet and engage in mutually beneficial interactions. As further confirmation of this, I reproduce below an extract from the written evidence submitted by Zeneca seeds – formerly ICI – to the House of Lords Select Committee on Science and Technology which was evaluating, between 1992 and the beginning of 1993, the impact of existing biotechnology regulation on the competitiveness of British industry.

> We believe that the U.K. until the late 1980s was developing a regulatory system that protected both man and the environment while encouraging investment in research and industry. […]. We believe that for the United Kingdom the Advisory Committee system has proved to be an effective way of regulating biotechnology. The Advisory Committees for Genetic modification (ACGM), Release into the Environment (ACRE) and Novel Foods and Processes (ACNFP) have provided a forum where scientific advice can be gathered and the evidence concerning a particular issue reviewed by a broad representation including "lay" involvement (representatives of the employers, trade unions, local government etc.)

But it is clear from the evidence submitted that this is not the case anymore. It is stated that "the debate over the last few years on the implementation of European Directives 90/219 and 90/220 has impeded the conduct of research and development in both academic and industrial sectors and there is no evidence that safety has been increased". For Zeneca, the problem is that the assessment of risk should, among other things, "take account of existing knowledge, for example, about the usual behaviour of crop plants" and "acknowledge the considerable body of experience gained by successful genetic modification work". These considerations give the impression that the approval and implementation of Directive 90/220 actually made scientific knowledge rather irrelevant.

In other words, ACRE as a meeting point failed to survive once the regulatory framework became a legal requirement. Loss of information became an issue and the support shown towards regulation by many active players became less straightforward. As information got lost, technical and scientific information lost its centrality as a way of solving disputes, building consensus and making decisions. Biotechnology, and GMOs more specifically, in the very words of the interested parties, became an exquisitely political issue instead of both a political and a scientific one, to the point that I1 claimed that PROSAMO was almost abandoned by his organisation because "it didn't provide ammunition" in the struggle that started after the 90/220/EEC was passed.

It is now important to problematise these claims a little more. What is the relationship between ACRE as a statutory body and loss of information? How should this have affected the social standing of science? What were the repercussions on PROSAMO? What does this say about the institutionalisation of GMOs?

## *7.3 ACRE and the move to a statute based regulation*

Beringer argues that when submitting applications to ACRE became a legal requirement, people felt that their integrity, which Chapter 6 showed being relevant for scientists, was questioned. We are not talking here about top managers in the bureaucratic hierarchy with little involvement in the practical everyday running of specific sections of the company. We are talking about the work of reputable scientists working within both the academic and the private sectors, whose practice begins being under scrutiny not by their peers, but by the wider society, as if scientists were not to be trusted anymore – as if they were not applying moral standards in their work. Because they were resentful of this lack of trust, applicants became "less forthcoming", and it was therefore more difficult to ask questions that one did not have the right to ask. The logical chain of the argument is in my opinion a bit puerile, connecting resentment with loss of information. My impression is that the two are connected in the opposite way. It is because of loss of information that scientists presenting their projects start to become resentful. They also start to think that they are not trusted anymore, and therefore feel even more resentment.

### 7.3.1 The bureaucratization of GMOs

It should be remembered that after 1984, releases into the environment were formally but effectively governed by a voluntary system of controls centred around the work of a committee run by experts, particularly molecular biologists. The committee worked very much as a form of self regulation of the scientific community, which enjoys a high status within the social hierarchies. This was made very clear by Beringer, who said to the Guardian, on November 3 1987, that no one would have risked ruining his career by releasing organisms without authorisation (see Chapter 4). Besides, as seen, scientific information and the expertise needed for producing and managing it were considered central in solving disputes, problems and making decisions. A profound change took place when ACRE became a statutory committee: to use one of my academic interviewees' words, GMOs became a bureaucratic issue.

The oral evidence provided by Geraldine Schofield to the House of Lords Science and Technology Committee in 1993 is very interesting from this point of view. On page 142, S1 claims:

> This is what happened in the United Kingdom, the Directives were enthusiastically picked up and incorporated into United Kingdom law very much on a word by word basis, whereas other countries actually looked at the objectives and approached them with some flexibility. As I mentioned, things such as Annex 2, most releases in terms of Europe have been transgenic plants and lot of the detail in the 220 really is for micro-organisms. Other countries have incorporated the annexes very flexibly, which we have not done. We have 89 questions which we have to answer in our submission, which are very specific and exactly the same as in the Directive, and in terms of plants there are many that are not appropriate.

Schofield stresses that the UK industry "got tied up in the bureaucracy" and is explicit in denouncing the difficulty in changing the situation in her reply to a question from Baroness Platt of Writtle:

> **Q**: The problem you will have to get rid of the 89 questions is going to be very difficult?
> **A**: It is indeed.

Schofield then makes quite clear that the bureaucratic data – data produced by filling forms – came to coincide with biological data. The bureaucratization of GMOs implies the crystallization of GMOs as a distinct category. There are other areas where bureaucratic and biological data coincide. When we are asked to tick our sex in forms, we can only chose among two alternatives, male and females, frequently associated with having a penis or a vagina. Often, at least at a more commonsense level, the chromosomal combinations XY and XX are used as the justification for thinking that only males and females are the 'natural' forms of humans (Holme, 2007). In the case of sexual status, bureaucratic data is considered and used as biological data, even though biological reality is far more complicated, given that there could be an interesting variety of sex chromosome combinations. Besides, any improvement in our knowledge of chromosomes does very little to change the way we categorise men and women. Thus bureaucratic data is well shielded from new information.

As in the case of sex, bureaucratic data when dealing with GMOs define the biological identity of the organisms. In this context, it is not the scientist but the bureaucratic form that has the power to establish what reality is. When ACRE became a statutory committee then, scientists not only lost the prerogative of defining what is what, but the reality that got crystallised was significantly different from the "expected reality" they wanted to describe – that is, that the distinction between GM and non-GM is not a significant distinction. Scientists involved in GM work therefore had to deal with a reality they did not particularly like, with very little power to change it through new information, which is the main tool through which they express their prestige as a status group. The difference from the previous situation is significant. Before

ACRE changed its nature, science was at the centre of the stage. It was used to find agreement, to define and solve problems and to exchange relevant information. Thus, scientists were really central to the activity of many of the institutions involved. With ACRE as a statutory committee, scientists simply became bureaucrats who needed to follow standard procedures in which the role of their expertise, their exclusive ability to produce credible information, was limited.

## *7.4 The nature of regulation*

At this point, it is important not to fall into the trap of attributing the powerlessness of knowledge to any inherent nature of legislation. It is not the statutory nature of ACRE as such that made GMOs a bureaucratic issue, nor the European Directive, otherwise there would have been similar responses to legislation in all European countries. Actually, Schofield is explicit in saying that regulation is really open to interpretations, as the experience of other European countries seems to show. For example, in November 1992, Belgian authorities proposed a simplified procedure for the notification of the deliberate release of genetically modified oilseed rape and sugar beet in the environment. A copy of the proposal was sent by fax by Nigel Poole from ICI Seeds to various people including Geraldine Schofield. Poole writes:

> I enclose a proposal by the Belgian Authorities to “deregulate” field trials of oil-seed-rape and sugar beet. This will be discussed by the European Commission at the end of January [1993]. The UK has also proposed a “fast track” for certain crop plots. I cannot circulate this). [sic] I think the Brits would have problems with these two crops. The French are developing a similar proposal; I have only “read a copy left on a desk” so I am not sure what they are actually going to propose. My SAGB colleagues and I are going to try and get agreement on these proposals.

Poole’s and Schofield’s contributions highlight that how things are done has very little to do with any inherent characteristic of regulation. Regulation can actually be better understood as a matter of power – the power to mobilise resources needed to make a given interpretation of regulation the dominant one. Thus, no regulation or statute could have made the GM one a bureaucratic issue. The most likely culprit is instead the context of social interactions where a given interpretation has become dominant. In other words, the bureaucratization of GMOs and its effects can only be understood by looking at policy actors involved in the debate and the structure in which they operated. This is further confirmed by the Unilever interviewee who originally brought up the issue of ACRE's members not being able to help the applicant anymore once the committee became statutory. I asked the interviewee for clarifications on this point. Could the members of ACRE not be a bit more informal and keep the networking and debating functions of ACRE alive? What were the actual constraints placed on the members? The answer was:

> We were sort of instructed that we weren't allowed, if you like, to help the people submitting the applications. The secretariat said "under the legislation you have to accept this proposal or reject it". You have to give reasons why you are going to reject it, obviously, but they couldn't come in and we couldn't have a debate with them and say "well if you change this bit here and there you might be ok". It wasn't that explicit, it was more implicit. The secretariat would have much more involvement with the papers, with sort of saying "well this is what we need to do" and so you felt, it was implicit rather than explicit that this debate shouldn't happen as it has been doing in the past. […] We were said that the debate with the scientists whether this [a given proposal] was a good idea or a bad idea was not the purpose of the committee. That was explicit. […] We had representatives from several different departments. And certainly from the environment department. And it was very much when it became statutory "we are not actually discussing with the scientists their science or where their project might be going. We are now just dealing with this proposal in front of us". And that was said, you know, "we are either looking at this proposal or not, you should not direct the scientist about their science, this is not what the committee is about". […] It was not to them to make the mistakes [referring to government officials].

In the light of Chapter 1, what can be witnessed in these words is a clear manifestation of bureaucratic politics (Allison, 1971). Within the frame of bureaucratic politics, policy flows "from an amalgam of large organizations and political actors who differ substantially on any particular issue and who compete to advance their own personal and organizational interests as they try to influence decisions" (Clifford, 1990:162). As put by Radaelli (1999) "fragmentation, coalition formation, bargaining, networking and negotiation in functional arenas are the second feature of bureaucratic politics" (p. 761). Indeed, it should be remembered that Chapter 1 described ACRE as the result of a political compromise mainly between the HSE and the DoE. In 1988, the DoE established its own committee for releases into the environment, a move that was widely criticised by members of the HSE committee. Through this new committee first, and ACRE subsequently, the DoE was seeking to rectify a fairly negative reputation of incompetence. Beringer was quoted by The Times, on October 10 1989:

> It is very important it [the Department of Environment] should be seen to be involved in this area. My only misgiving is that the DoE does not have a perfect record as watchdog for instance, over the water industry. Whatever happens, we need to be seen to have teeth.
> (Hill, 1989)

In other words, with the involvement of the DoE the GM debate moved from an epistemic community logic to one of bureaucratic politics. New and different political priorities entered the debate. The DoE wanted to exploit the GM issue to gain political influence and in the new context, ACRE members were more or less implicitly instructed that they could not help the applicants through their application process anymore. This move in part allowed the government and particularly the DoE to avoid responsibility. But more generally, the literal interpretation of regulation mentioned by Schofield in front of the House of Lords Science and Technology Committee, without the possibility to have a "highly scientific and technical debate" with the applicants as well, became a solution to political disagreement. Rule-following really was the expression of a political compromise among those who wanted to change the existing practices (academic and industrial scientists wanted to establish a "fast track" procedure rather than keep going with a case-by-case review of releases) and those who wanted to formalise it (the DoE). The DoE had the easiest position. As shown by Messner (2008) in her work on the FDA approach to drug regulation in the US, "it is notable that rule-making as a formalization of existing practices seems to be at least as common as rule writing to establish entirely new procedures, and arguably more common" (p. 293) and that in the regulatory context "performative enunciation accomplishes a certain sort of priming[56], but by itself does not offer the same quality of priming evident when practice precedes the enunciation".

The bureaucratization of GMOs thus had nothing to do with the rules as such. Rule-following is not something inherent to the rule. Instead of determining behaviour, rules guide social action towards the achievement of given objectives. As ethnomethodology teaches:

> many classes of actions are not analysable by reference to clear-cut rules which either delimit them as a class or, still less, could be held to constrain or determine their empirical occurrence. Rather, these actions are produced and recognized by reference to reasoning procedures which draw upon complex, tacit and inductively based arrays of 'considerations' and 'awarenesses'. These reasoning procedures address such matters as what some particular action accomplishes with respect to the environment of activity to which it is addressed; what analysis of that environment is exhibited in the actions; what assumptions about the social and personal characteristics of the participants in the setting are displayed in the action and so on.
> (Heritage, 1984:128-129)

[56] The concept of priming is taken from Barnes (1983) and it indicates the need of social practices to get established and widely accepted, in other words to become social institutions. Following Barnes, people usually initially perceive a problem in their established practices and will act in a way to solve the problem. If the problem is temporary, the alternative course of action will be considered an exception. But if confronted with similar problems for a prolonged period of time, the solution of which requires more or less the same course of action undertaken to solve the first problem, then the exception becomes habit, and consensus will form around that particular course of actions. At that point, a term to formalise the now well established social practice will be created.

We are now better placed to understand the sense of frustration expressed by the scientists involved in PROSAMO and their impression of having lost prestige. These scientists start their regulatory experience as those who are entitled to produce a credible account of the world. They are at the centre of the stage, highly regarded by all the relevant social agents. Scientists can jump easily from one institutional affiliation to another – they are scientists, entrepreneurs, regulators and members of the public. The changing nature of ACRE represents a significant change in the position of scientists within the social structure. As rule-following becomes a political requirement, GMOs become a bureaucratic issue and scientists turn into bureaucrats. With scientific expertise devoid of its role of consensus building, scientists could not do much if not relying exclusively on their primary institutional affiliations. The game became more confrontational and self-centred, with loss of information and little debate among institutional players[57]. Science, from this point of view, simply represents an instrument at the mercy of opposing interests, and these interests acquire much more visibility. One emerging problem is that if expertise is, or is perceived to be, "interested" (see Chapter 2), its credibility diminishes or even disappears[58].

### 7.4.1 The precautionary principle

It is important, at this point, to discuss the way Tait (2001) has tried to explain public resistance towards biotechnology. She introduces an interesting distinction between value-based and interest-based responses to controversial issues, claiming that if something affects one's fundamental value system it is actually non negotiable (NIABY), while interest-based responses can instead be accommodated, for example through compensation (NIMBY). She explicitly links NIMBY responses to a "regulatory culture which does not recognise the

[57] New channels for debate among institutional players will be established, as did Unilever by sponsoring a series of initiatives during the 1990s that culminated in the publication of Uncertain World. See Doubleday (2004) for more on this.
[58] Other scholars have discussed the changing role of professional expertise in the last three or four decades and about their participation in political controversies. Besides the already mentioned work by Calvert (2002), see also Barnes (2002), Nelkin (1975; 1982; 1992), Teich (1974), Primack and Von Hippel 1974), Weingart (1982). For a good example of experts' involvement in regulatory bodies in the US see Jasanoff (1990), where she introduces the concept of regulatory science. For accounts of the movement of science from a community of peers to a commodity see Gibbons and Wittrock (1985). For an alternative interpretation of the changes occurring in the institution of science see also Fuller (1997).

validity, legal or intellectual, of any objections which are not based on 'rational self interest' supported by scientific evidence" (2001:179). This quote is interesting because it partly confirms what this thesis has emphasised: that a proper understanding of the GM debate needs to take into account the role professional expertise plays in it. In one of her recent conference talks (Exeter, January 2007) she clearly made the point that in the current GM debate science has become only marginally important. More precisely, she claimed that the introduction of the precautionary principle made value-based responses to technology particularly relevant within the debate, to the point that it undermined the role of evidence in decision making about risk. This attempt to explain what happened at the institutional level is close to what has been discovered in this work through the study of PROSAMO. There is, however, an important difference. The decreased role of science should not be imputed to any inherent characteristic of the precautionary principle.

If what has been claimed in the previous section is true – that rules and principles are flexible entities that are used by social actors as guidance for their behaviour, but do not determine behaviour – there is no reason to think about the PP differently. As a confirmation of this, it would be enough to consider the evidence by Geraldine Schofield to the UK House of Lords Select Committee on Science and Technology in 1993, where she claims that European Directive 90/220, which is precautionary in style according to Levidow (1994), despite being the same for all countries did not create the so hoped for "level playing field" that would have guaranteed the exploitation by industry of a truly unified market. The directive was interpreted differently in different national contexts during its implementation. The following comment from one of my Unilever interviewee, where she describes the difference between product-based (risk-based regulation) and process based (precautionary legislation) approaches to regulation, reveals how the people involved in regulatory practices are aware of the flexibility of rules:

> **Q:** So do you think the committee [ACRE] worked as a sort of networking instrument…
>
> **A:** Yes, almost as a sounding board in a way. But once you, you know, as it became [ACRE] a legal entity you couldn't do that anymore. I mean,

> we can go to that whole process and product debate…one of the things was what the Americans always said that they regulated the product not the process by which the product was produced. But I have always thought that that debate as never as clear as that. It's just not as clear as that because if you come from where I come from, in the food industry, the actual process by which your product is produced is also regulated. Well, it is more regulated now but it always was a risk assessment. It has this analysis in critical control points, which is now in use in a wide range of industries, but very much taken by the food industry to analyse its whole process of producing their food. So you don't actually look, in the food industry, I think it was very early on, you don't actually say, I'm sure you remember, you know, you've got cans coming off the line you take ten and test them to see whether they're ok. That was really an old fashion way of doing it. Quality control in these days is not just end quality control. You control the whole of the process. So you have, you do hazard analysis, you can chose critical control points down your process and those are the ones you control. If you control those the product at the end of it is ok. Of course your product control would still be on nutrition and all these other things… how much salt and whatever. But you, and there are obviously products and marketing things on products, but you also analyse the process now, since 1990 in the food industry it has become more regulated. It is regulated, so I think this "we're gonna look at the process not the product" is, I don't think it is as clear cut as that. I think the debate was, from the US point of view, was…I think some of the debate was a bit spurious. I don't believe some of it. It's too clear cut. It's never been so clear cut as that.

It is interesting at this point to notice that there is not a single definition of the precautionary principle. Majone (2002) claims that the PP "is an idea (perhaps a state of mind) rather than a clearly defined concept, much less a guide to consistent policy-making" (p. 93) and that Rehbinder (1991) "has distinguished no fewer than 11 different meanings assigned to the precautionary principle within German policy discourse" (p. 93). He then compares the interpretations of the PP given by the European Commission with the formulations in the Rio declaration:

> Perhaps the best known statement of the precautionary principle is provided by principle 15 of the declaration of the 1992 UN Conference on Environment and Development (Rio declaration):
> In order to protect the environment, the precautionary approach shall be widely used by States according to their capabilities. Where there are threats of serious and irreversible damage, lack of full certainty shall not be used as a reason for post-poning cost-effective measures to prevent environmental degradation.
> It is important to notice that the similarity of different statements of the principle is often more apparent than real. […]
> Again, the Commission quotes with approval principle 15 of the Rio declaration, even though the standards set by the drafters of the declaration (a threat of serious and irreversible damage, measures must be cost-effective) are a good deal stricter than the ones the Commission advocates. For example, according to the Commission a precautionary measure may be justified if there are 'reasonable grounds for concern that the potentially dangerous effects on the environment, human, animal or plant health may be *inconsistent with the chosen level of protection*' (Commission, 2000, p. 10; emphasis added) – a significantly more permissive standard than the threat of serious and irreversible damage.
> (p. 94)

Regulation then, and particularly the PP, cannot by itself have granted access to ethical concerns, as argued by Tait. I am not claiming that Tait is incorrect when she says that the implementation of the PP in the early 1990s coincided with an increased disinterestedness for scientific expertise in decision making – expertise that, as repeatedly claimed, served to formalise a consensus among the dominant institutions. My point is that the PP should not be blamed for things not going according to plans.

If ethical concerns entered the debate, this is because some social agents were able to mobilise the resources they needed to make a given interpretation of the PP the dominant one. This process was facilitated by the fact that the GM debate moved from an epistemic community approach to a logic of bureaucratic politics – a move that bureaucratised the GM issue making the role of scientists as recognised professional experts superfluous.

This of course raises new questions. If PROSAMO was initially meant to be an authoritative piece of science that could be used for regulatory purposes, within the logic of an epistemic community, what did it become after science and its professionals felt downgraded? Did their attitude towards GMOs changed as well? How did they start to interpret the new category? This thesis will elaborate the answers to these questions in the next chapter, which will also show how ethical concerns may have entered the debate. Before moving on however, I would like to emphasise some points.

## *7.5 Concluding remarks*

The second chapter has shown that the current attempts to explain public resistance towards GMOs are not completely satisfactory. There is now room for some more considerations. It has been said that when the dominant institutions initially introduced the concept of 'genetic engineering', they were referring to the process as something uncertain that needed to be taken care of by experts. The category had to be abandoned once experts established the safety of the new products. The move from an epistemic community approach to one of bureaucratic politics, however, has crystallised the GM category, and with it the fact that the process constitutes the basis for the definition of GMOs. In other words, what got crystallised is the fact that GMOs are defined by the way they are made rather than by what they do. This definition, in turn, has come to constitute the basis of public awareness in the subsequent stages of the debate. This is to say, the focus on the process identifies GMOs as a distinct kind from other products, which are usually defined by what they do and not by how they are made. GMOs have become then a distinct brand, with no explicit connection to the needs of the consumers – which are met by products with certain characteristics – and with which the consumers are unfamiliar. The visibility of the process, in turn, allows for very specific and effective attacks by social movements, in the sense that their focus needs not to be on the features of the products, but on the fact that the process to obtain those features is monopolised by large multinational corporations and on the undesirable social consequences this monopoly may have. The fact that scientific expertise has lost relevance in the debate does not help. Actually, the bureaucratization of the issue has made disagreement among experts even more visible, thus fuelling even more the suspicions of the public.

It is also easier to understand now why, at least in part, the 'genetic engineering' formula began to lose grip towards the beginning of the 1990s. When expertise was the name of the game, the 'genetic engineering' formula was more apt to describe what was going on at the institutional level. When expertise became marginal as GMOs became a bureaucratic issue, 'genetic modification' better reflected the pattern of relationships established among the social actors involved in the debate. Of course, I am not claiming that this is the only cause. As anticipated by Levidow, and as documented in Chapter 8 of this work, the movement towards the use of 'modification' has been facilitated by a public relation operation carried out by the companies. However, one should wonder whether seeing the use of the term 'modification' as a solution to a negative public perception has been stimulated by scientists' expertise not being very helpful in the first place. True, the 'modification' formula took time to become established in the public domain. But there may be an explanation for this too. All these changes in the policy arena had repercussions on social actors, but it is likely that the social actors that suffered the most from these changes have reacted against them. As the next chapter will explain, experts did not simply give up their role, but they actually tried to redefine it through both new efforts in communication and new initiatives beyond the political arena (see Doubleday, 2004). The definitive establishment of GMO as the dominant label used to identify the new products only arrived in 1998. The way it arrived is astonishing actually. Between 1997-1998, 'modification' was used in 2261 publications against 3132 for 'engineering'. The following year, this was reversed with GM increasing by four times to reach 8568 publications, against a 'mere' 6994 for genetic engineering. Maybe a sign that experts were starting to give up? A1's strong feeling of resignation reported in Chapter 5 should be remembered. It seems then, that these changes had an impact on scientists' behaviour. Actually, what I was able to identify when talking to the people doing the PROSAMO experiments was a strong emphasis on the recognition they received by the rest of the scientific community. A1 said the following to me with visible satisfaction:

> The strength was that it [PROSAMO] was a properly designed ecological field experiment. Well replicated, randomised field experiment. That had all the statistical power to demonstrate what was self evident from the beginning that genetic modification was not going to affect the ecology of these crop plants, of any of the 4 species. So in that sense we were completely vindicated. We did all the hard work, got the answers, published them, much higher profile than the industrial sponsors…the fact that we got published in Nature twice was a tremendous surprise to the sponsors. They thought we'd have been in some really really small third rate central European applied ecology journal. They were rather taken aback when actually a quite general wide public interest…they didn't expect that.

May it be that a sense of resignation in the wider public context was compensated for by scientists turning inwards towards their own institutions? It would seem to be the case if considering what was claimed by U2, who expressed disappointment for the fact that academic scientists focused solely on publishing in academic journals and publications (Crawley, 1990; Crawley et al. 1993; Dale et al., 1992; Dale et al., 1993; Silcock et al., 1992) without paying much attention to popularising their experience, when discussing about the PROSAMO brochure (see Chapters 3 and 8) and about attempts to disseminate the PROSAMO results to the wider public. The following quote by A1 may help to understand the reasons for this retreat:

> Now subsequently, after the results were out […] all the opponents were saying "it's obvious". It wasn't obvious at all in that sense because no one would have done it before. We knew what the answer was going to be but I think we had to do the experiments to show that scientists were right. After the results came out then the opponents to GM crop

technology would say things like “but they did completely the wrong experiments, they should have been doing the experiments in the circumstance in which the herbicide was being applied in order to give the GM plants a fitness advantage”. But we were explicitly working in the situation outside agriculture, outside the herbicide applications on trial, the simple question was “does altering the genotype alter the ecological performance of these crop plants?” So we felt slightly short changed by our sponsors because they didn’t back us up on that. They then went on the defensive “well of course it’s true that if you have a GM rape plant in an environment where this particular herbicide has been sprayed it will increase. Yes, right, precisely [laughing]. And that’s why they designed it, you know?...But nobody has convinced me that a natural habitat routinely sprayed with glyphosate say, would be more invaded by GM oilseed rape. It’s likely to be more invaded by much more competitive glyphosate resistant strains of other plant species. Do you see my point? Because in a sense the results were very obvious scientifically the ground rules had forever been changed and that was another way why scientifically it was a very irritating project to be involved with.

The consequences of this perceived change in the social role of science and scientists will be explored in more detail in the next chapter.

# Chapter 8 – Rebuilding Trust

The previous chapter argued that the changing nature of ACRE had important consequences on the self perception of those working on genetic engineering for release purposes. Basically, scientists lamented a loss of social standing in a political environment in which science could play only a marginal role. For example, I1 expressed a profound disappointment in the small role science was allowed to play in the European context, which was defined as being highly political. When there was a voluntary system of controls, science and scientists were at the centre of the stage. Decisions were taken by experts after “highly technical and scientific debate” (U2). When ACRE became statutory, biological data were substituted with bureaucratic procedures and scientists turned into bureaucrats. Their role as providers of credible knowledge and information lost relevance.

If the position of scientists within the social structure changed, if the authority that was coming from their recognised expertise was made irrelevant, if the basis of their credibility was in this way undermined, it appears quite obvious that their self perception must have changed significantly too. An interesting example was the profound sense of resignation expressed by A1, when he said that scientists are not listened to anymore (Chapter 5). This sentiment is clearly linked with what happened in the early 1990s at the regulatory level. It is then that scientists’ attitude started to be a bit fatalistic, as if they could do very little to make a difference in the world they were living. It is then that they started to think that science had lost its credibility and that therefore it was not trusted by the rest of the society. In the area of genetic engineering, scientists’ changed social position was experienced by them as a questioning of the role and consideration given to science by the wider society.

It is now time to look in more concrete terms at the consequences of this perceived loss of social standing, again using PROSAMO as a guide. Section 8.1 shows how, in the context of genetic engineering in the UK, ideas about public perception and communication of biotechnology are associated with this sense of being distrusted felt by scientists within both the private and the public sector. In 8.2, the final stages of PROSAMO serve as a concrete example of the effects of these ideas. It is shown that the conclusion of PROSAMO was taken as an opportunity to rethink the way biotechnology is communicated to the public in order to restore credibility. Particular attention is placed on the psychometric research on risk perception and its interpretation of the communication of risk, as described in 8.3. Section 8.4 shows how the psychometric research was used in conjunction with Public Relations expertise as a resource for the communication of the PROSAMO initiative – communication that found concrete expression in the PROSAMO brochure. Section 8.5 speculates that this kind of communication may have contributed to encourage distrust in science rather than to restore it, combining its effect with local awareness of the fallibility of science and with widespread moral issues about the political impact of technological artefact.

## *8.1 Credibility, Public Perception and Communication*

The weakened confidence in the social role of science held by its practitioners emerges quite clearly if one examines the testimony provided by the witnesses before the already mentioned House of Lords Select Committee on Science and Technology (see Chapter 7). One of the issues raised by the committee was the problem of public acceptance of biotechnology. The almost universal response given by the interested parties was that a positive public perception could be fostered through the provision of information from a credible and authoritative source. In other words, people's ignorance on biotechnology should be bridged by a trustworthy source of information. For example, a draft memorandum (from the Unilever archive) of the Food and Drink Federation prepared for the Committee chaired by Lord Howie of Troon argues that "consumer education is urgently required to increase public understanding of the nature and benefits of genetic manipulation in its various applications to food production". Similarly, in the Chemical Industries Association (CIA) written evidence it is stated that "the general level of technological understanding in the community is low. This is said particularly to be the case of Britain. Whether this is so or not is debatable, but it is certainly true that science is becoming ever more specialised and the gap between experts and the public is inevitably widening". For this reason "explanations about safety will inevitably require an unusual level of technical education. This will demand substantial resource and persistence". The BioIndustry Association (BIA) draft of its evidence similarly stresses that "there is clearly the need for industry and Government to work together to ensure that the public has an accurate understanding of biotechnology". The BIA however, adds to the issue the fact that public understanding needs to be achieved by providing balanced information:

> It is in the interests of everybody that the general public develops its views in a balanced way through open debate and that this will only be achieved by provision of reliable information. All attempts towards dialogue and provision of such information are to be welcomed.

Zeneca's memorandum to the Committee raises similar considerations:

> In order to encourage public confidence there is a need for a focused campaign aimed at explaining to the public in honest, non-scientific terms the technology, the regulatory safeguards and the benefits arising from each sector of biotechnology. There is also the need for a source of information which in the view of the public offers a factual and unbiased service.

Thus, there seems to be a lot of emphasis on the need of having a body able to guarantee authoritative, credible information. The evidence from the Agricultural Genetics Company (AGC) echoes these concerns, but it also makes explicit that scientists cannot reassure the public because they are not trusted:

> Thus the information given should be in non-scientific terms and should highlight the regulatory safeguards and benefits for those products from each sector of biotechnology (eg. pharmaceuticals, agricultural, food). At the present time the public credibility of science itself is at stake let alone biotechnology, so it is vital that an independent body providing unbiased, factual information [sic].

In a similar manner, in a very rough draft of the evidence from Unilever it is stated that "it is not only biotechnology but science as a whole which has lost public credibility. Society is more questioning about technology and the only way to redress this is to be prepared to enter into dialogue with non-Government organisations to answer the 'what if' questions and, for there to be an independent body pro-active at providing unbiased factual information". To return to the CIA evidence, it is stated:

> We feel it is important to first understand why the public acceptance of biotechnology is falling. The word "biotechnology" projects a negative image, combining "life" with "technology" in an era when technological progress is not universally seen as benign nor its practitioners trusted.

As a confirmation that science is not perceived as having the status to directly and positively affect public perception there is the oral testimony of Professor Jarvis, member of the FDF Research Working Group, who told the Committee:

> There is the start of a lot of educational activity but, in general, I am not sure if the consumer would prefer to have assurances from Government or whether the consumers are sometimes as cynical of assurances from the Government as they are of assurances from industry or the scientific community because, of course, we have to recognise that science in this country does not hold a particularly strong position.

On the same line is the document written within CBI as a preparation for the oral examination of its representative, Geraldine Schofield:

> CBI has concentrated on the macro issues, and is at the moment trying to address the negative image that manufacturing, industry and science and technology has in the minds of young people.

All these documents were produced between 1992 and 1993, when PROSAMO was drawing to a conclusion and right after Directive 90/220 was implemented, by the beginning of 1992. There are now a few points that need clarification. First of all, the link between the bureaucratisation of the GM issue and the idea that science has lost its authority and credibility should be demonstrated by now. Secondly, one may argue that the concerns and comments about trust and public perception that were made before the Select Committee on Science and Technology basically came from industrial people. True, but other sources will highlight an interesting movement also within the public scientific sector, which is closer to the academic world. The PROSAMO archive will again reveal some interesting general tendencies.

## *8.2 PROSAMO and Public Perception*

### 8.2.1 Concluding PROSAMO

When PROSAMO was initially conceived and set up, it was meant to be the piece of science that could justify the actions of the relevant social actors involved. The fact that scientists were suggesting caution towards GMOs could justify the adoption of a precautionary principle and a case-by-case approach. PROSAMO as a finished programme could justify the relaxation of controls and the abandoning of GMO as a significant category. Thus, all the objectives of the founders of PROSAMO were inextricably linked to, and actually dependent on the authority of science, which could fuel public support towards the new technology and its applications to agriculture. It is clear that when people who were hoping to achieve those objectives through their authority as scientists started to feel that their authority was questioned or made irrelevant, the achievement of these objectives became more problematic, particularly the creation of public support. This condition was a problem for companies too. One should remember that companies are heavily dependent on science as an institution to make their claims credible. If science is perceived to be irrelevant, to have lost its authority, it is obvious that industrialists will feel that they lack a powerful ally in the public debate. Furthermore, scientists working within an industrial setting will fear for their social standing within the organisation. These concerns materialised when ACRE became a statutory committee and GMOs a bureaucratic issue.

Within the new context, PROSAMO's meaning needed to change too. Obviously, with scientists thinking their authority and prestige were being questioned and public trust in science being lost, PROSAMO could not be used as a way to affect regulation and to create public support towards the release of GMOs into the environment. Besides, even trying, it would have been difficult to obtain any significant success given the bureaucratisation of the GM issue. Therefore, PROSAMO turned from being an exercise of the authority and credibility of science, to being an exercise to recover a perceived loss of authority and trust.

The most significant element signalling a changing attitude towards PROSAMO is the fact that when the experiments ended, PROSAMO was far from being over. PROSAMO actually finished, at least from a public point of view, towards the end of 1993, with the publication of a brochure that was meant to circulate among ill informed but well educated people representing larger constituencies. Towards the end of May 1993, the brochure was still in preparation. This is what Dietz wrote to Schofield the 26th of May 1993:

> The PROSAMO Steering Committee on 25 May endorsed the proposal for using the surplus funds to disseminate information and, in particular, for a professionally-written, glossy four side A4 covering the importance of crop biotechnology, the organization/policy of PROSAMO and a plain man's summary of the result on plants. The target audience is the intelligent but ill-informed. David Fishlock (a respected UK journalists, ex-Financial Times) has produced the attached draft.
>
> **It would be very helpful to have by end-June:**
>
> - **your detailed comments on the text**
> - **suggestions for a positive and catchy headline**
>
> […]

The reply by Schofield is dated 2 July 1993, where she provides some comments on the draft. But it is clear that in October 1993 the brochure had still to be circulated. The 10th of October 1993 Jonathon Thomas, the project manager, sent the members of PROSAMO the minutes of the May 25th meeting, with the following message:

> Dear Subscribers,
>
> I now enclose copies of the draft minutes of the final SC meeting, I apologise for the fact that these were not circulated at the time, an

omission on my part. As further meetings are not planned, any queries will have to be taken up by correspondence.

[…]

Roy plans to write in the near future regarding the leaflet, display boards and possible support for the Reading Biotechnology Education Centre.

Regards,

It is not clear what the actual publication date was, but it is not very relevant at this point. What matters is that it took a long time to produce this 4 page brochure, especially considering that nothing else had been produced to promote the results of PROSAMO to a wider audience. The question is: why did it take such a long time? If the PROSAMO results were meant to convince regulators and the public, they should have come out straight away. The point is that they were not meant to convince anybody because, as seen, science and scientists' expertise became irrelevant. In this context, PROSAMO had to change its nature too, and this implied a process of rethinking its purpose and remit. As anticipated already, as scientific information became irrelevant new needs emerged: improving the public perception of science and rebuilding its credibility. As information was not considered sufficient anymore as a way to create public acceptance, new solutions were required. Of course, searching for new solutions takes some time and only after a problem is well defined is it possible to look for a way to solve it.

### 8.2.2 Communicating Biotechnology

From the analysis of the Unilever archive, the opportunity for finding a solution to the problem of credibility came from scientists working in the public sector and representing the Research Council. Through these scientists, some of the major companies represented in PROSAMO started to get involved, towards the beginning of 1992, in a proposal for a new LINK project which was supposed to be explicitly concerned with public communication and perception of biotechnology. It all started with Professor Donald Boulter, a molecular biologist at the University of Durham acting on behalf of the AFRC, who approached the External Affairs department of Unilever "to assess Unilever's interest in a public perception/attitudes research programme on GMOs". This happened at the beginning of 1992. In the same period the PBI was approached by Professor Renton Righelato on behalf of the SERC. The ESRC was also involved in discussions about the new project at a very early stage. Thus, following this interest from the research councils, Boulter met with Chris Bunting – Unilever's Public Affairs manager, and Geraldine Schofield, from the microbiology section at Unilever Research, who already played an important role in PROSAMO. The meeting took place the 30th of April 1992. On that occasion, Boulter agreed to contact the Government Chemist, suggesting a meeting with industry "to discuss the problem of communication with consumers" (fax, May 29 1992, from Bunting to Schofield). Thus, on the 1st of May 1992, Boulter wrote to Dr. Roy Dietz – who was the DTI representative in PROSAMO – of the Laboratory of the Government Chemist (LGC), informing him that during the last meeting of the Biotechnology Joint Advisory Board a widespread interest emerged, especially among industrialists, to start a LINK project on the communication of biotechnology to the wider public. The following is the entire text of the letter:

> Dear Roy,
> Further to the last BJAB meeting and suggestions for the new Link Schemes, my discussions with various industrial managers show that there is a strong desire on the part of the industry to be involved in a Link programme to explore the way forward of communicating to the public the benefits of Biotechnology.
> Thus, whilst industry feels, as far as regulations go, it can do this on a case –by-case basis, as Ed Dart said, this is not so with communicating with the public. There it sees a need to swap experiences in a pre-competitive programme. Having "lost" food irradiation, BST, pig hormone treatments, industry see this as the key issue for Biotechnology and has considerable concern that Europe will miss out relative to America and Japan.
> At first sight this topic might appear not to be highly scientific but industry feels consumer involvement is essential and hence the Link, using university academics and AFRC/MAFF institute scientists. Costs are not likely to be excessive but benefits would be great. Firms likely to be interested are: Unilever, ICI, Ciba-Geigy, Nestle and several others. Only

firms which have something to contribute, i.e. with a commitment to Biotechnology and presentation experience, should be considered.

I will be very interested in your comment. I have also copied this letter to Malcolm Carpenter.

Yours Sincerely,

As can easily be seen, some of the major companies funding PROSAMO turned their attention to this proposal: Unilever, ICI and Ciba-Geigy for example. Roy Dietz took a very positive attitude towards this new initiative, and was trying to convince the DTI to support efforts on public communication in biotechnology. This is what he replied to Boulter on the 6th of May 1992,

Dear Don,

Thank you for your thoughtful letter of 1 May, suggesting a collaborative programme on public communication in biotechnology. The thought is timely since public perception is to be the principal topic for the two-day BJAB meeting in September and a proposal for support of a collaborative programme would do much to strengthen my arm in urging the DTI forward in this area.

It would be helpful to put a little more flesh on the bones of the thinking. What do you see as the mission of the possible programme? What is the academic resource that is relevant? What will be the products of the programme? I should welcome a discussion with the industrialists likely to be interested, in order to gauge the direction and seriousness of their interests.

I am copying my letter to Malcolm Carpenter.

Yours sincerely,

Dietz asked some more specifications about the possible programme. In particular, he wanted to know the aims of the project, what kind of academic work would have been required and what the practical consequences of this could be. Dietz questions were considered quite seriously by another External Affairs official in Unilever, Mr Byrnes, who wrote to Mr Bunter and to Schofield about his ideas on "communicating biotechnology". He suggested to organised an internal session, within Unilever, to evaluate the points raised by Dietz. This is the core of his letter, dated June 1st 1992:

> I think a link on 'Communicating Biotechnology' an excellent idea, but we will need an internal session before we sit down with Dr Dietz.
> Dr Dietz has asked the key questions. Translated into our terms they are:
> - what would the Universities be contributing
> - what would they research
> - what product would the research produce
>   - A psychological understanding of people's fears?
>   - Some advice on how to change attitudes?
>   - A module for school syllabus?
>   - Or some quite different approach?
>
> I think the Unilever pre-meeting Group might contain: you and I, Geraldine, Judy Gray, Jim Laslie.
> Jim should be asked to advise on how wide the bounds of Links can be pushed.

These exchanges are quite interesting. First of all, they clearly signal that public perception became the prominent issue. There had been attempts before 1992 to start a communication programme, but apparently they did not succeed. In a letter to Bunting and Byrnes, dated June 16th 1992, Schofield replies to Byrnes' points and reports that "there was a proposal for a communications programme some time ago (3-4 years) which was supported by Roy but fell through because of the lack of support from the then Minister (Lord Young)". But clearly the time seemed ripe for reflecting upon public perception and communication again, and I believe this should be understood in the light of the significant changes that took place in the political and regulatory context starting in the 1990s.

Secondly, the interested parties needed and were looking for the cognitive resources that could help them affect public acceptance of biotechnology. Byrnes asks what would kind of knowledge universities should produce and he is clearly arguing that if people want to change public perception they need to answer the following question: what should we know about the public and how would universities contribute to such an understanding? This is further emphasised by Schofield's June 16th reply mentioned above, where she claims:

> I think we need to consider Bill's point on the contribution of the Universities very carefully. Some work has been done under other schemes but mainly from a social/philosophical stance. I am not sure that a repeat of this will achieve much.

Here Schofield is referring to a position paper sent by Dr Boulter to Professor Jim Laslie from Unilever, in February 1992. In this paper, Boulter argues that public perception of science is mainly influenced by "a reaction called 'outrage'". This concept was first introduced by Peter Sandman (1986; 1987; 1989; 1993) who, in his own words, in the mid-1980s "coined the formula "Risk = Hazard + Outrage" to reflect a growing body of research indicating that people assess risks according to metrics other than their technical seriousness: that factors such as trust, control, voluntariness, dread, and familiarity (now widely called "the outrage factors") are as important as mortality or morbidity in what we mean by risk"[59]. The reference to the psychometric tradition is clear – a tradition that quickly became available within Unilever, as this fax from Schofield to Bunting dated July 2nd 1992 reveals:

> As requested I will chat over with Jim Laslie the in and out's of the LINK scheme and its relevance to a consumer communication programme in biotechnology. Our meeting is scheduled for the 13th July and I will let you know our thoughts.
> Incidentally I have discovered that the concept of 'outrage' put forward by Dr. Boulter was formulated by a University researcher in the US. I am endeavouring to get hold of the original papers. Also the detailed attributes of risk perceptions is based on a series studies also by an American research group.

[59] See http://www.psandman.com/indxoutr.htm

It is now time to explore in details the suggestions and reflections advanced by Boulter in his position paper in relation to the psychometric tradition and its approach to risk communication[60].

## *8.3 Risk Between Perception and Communication: the Psychometric Approach*

The psychometric approach modifies and refines Starr's (1969) conclusions by showing that the voluntary/involuntary dimension was just one of those used by people to rank risky activities. Other factors, such as the familiarity/unfamiliarity of risks, catastrophic/chronic and immediate/delayed effects, are used to evaluate the utility of a risky activity. On the basis of these attributes, each individual judges if risk is acceptable or not in order to seek maximum benefit. While acknowledging the existence of non-rational elements that cannot be quantified, this approach considers humans' agency as being individualist and rational from an idiosyncratic point of view. In other words, each person tries to maximise her or his own personal satisfaction by evaluating if a risk is acceptable or unacceptable on the basis of risk attributes that refer to both the cognitive and the emotional sphere of human experience. Risks can then be ordered according to their acceptability in relation to reasonable (if not rational) individual preferences[61].

As Starr's model, also the psychometric one is thought to provide help for policy-makers, this time by improving their communication skills in their relationship with the public:

> If successful, this research should aid policy-makers by improving communication between them and the public, by directing educational efforts, and by predicting public responses to new technologies (for example, genetic engineering), events (for example, a good safety record or an accident), and new risk management strategies (for

[60] The literature on risk communication is now huge, with a peak reached between the end of the 1980s and the early 1990s especially thanks to the psychological study of risk perception. See for example Hence et al. (1988) and Covello et al. (1988).

[61] For a commentary on the psychometric approach, see also Turner and Wynne (1992)

example, warning labels, regulations, substitute products) (Slovic, 1987: 281)

Exactly how these objectives are supposed to be achieved is highly unclear. In the same article, Slovic suggests that risk communication and risk management will not be successful “unless they are structured as a two way process” (p. 285). This poorly qualified claim raises questions of conceptual definition. What is “successful”? What does “two way process” mean exactly? What is meant by “risk communication”? What is the “improvement” about? In order to understand the meaning of this terminology, it may be useful to briefly examine other contributions offered by the complex network of collaborations in which Slovic worked.

In 1986, the volume 6, No. 4 of the journal “Risk Analysis” publishes two articles on risk communication, one by Ralph L. Keeney and Detlof von Winterfeldt, entitled *Improving risk communication*, the other by Paul Slovic, titled *Informing and educating the public about risk*. These two publications are used as exemplars of a wider range of publications that were becoming available around those years. The titles themselves are quite revealing. Indeed, the focus of the analysis is not strictly risk, nor the public, nor scientists, but the activity of communicating. This means that the focus of the problematisation of the science/society relationship shifts from the ignorance of the public to the “distortions” that science undergoes in the process of communication and to the difficult art of mediating. Indeed, what these two articles do not spare words to emphasise is the complexity communicators find in their activity.

Keeney and von Winterfedt identify a number of complex issues when dealing with risk:

1. Communication of risk is communication about a spectrum of alternative actions that can be taken to address risk. Members of the public only have to deal with yes or no decisions, which makes public discourses simpler.

2. When dealing with risk management, there is a multiplicity of objectives at stake and there is the need to balance them. Communicating the necessity of balancing them is not straightforward.
3. There is also the interdisciplinarity required to solve a risk problem. Communicating such breadth of knowledge is not an easy task.
4. Scientific analysis of risks provides highly uncertain results, and this is thought to run counter to the expectations of the public which is thought to seek certainty.
5. Uncertainty is then magnified frequent disputes among experts who often put forward different conclusions. Within this context, insecurity and speculations have a lot of room.

What these five points emphasise is the belief that people look for certainty in scientific claims about risks, rather than probability statements. Slovic suggests there is the need to find a solution to people's tendency to self manage their own anxiety about risk by making risks look so small that they can be safely ignored or so large that they clearly need to be avoided (p. 405). In other words, there is the need to teach people to cope with uncertainty, when they usually deny it. Keeney and Van Winterfeldt go on identifying other complex aspects of risk communication:

6. When communicating risks, one must take into account the opposition between "the analytic structure that is to be communicated and the legal arenas, in which much of the communication occurs" (p. 419). Legal requirements often provide constraints that cannot be met from an analytical point of view and that sound irrational. When legal documents state that costs cannot be taken into account when implementing a regulation, the consequence would be the necessity of significant changes in the economy that would be even more problematic than the social costs. This means that cost considerations cannot be avoided in many cases, and these considerations must be done in a way that maintains the perception that the legal interpretation of legislation is followed. This makes risk communication even more complicated. "It is clear that such processes, far from furthering *effective* (my italics)

communication, can create mistrust and undermine the credibility of regulators". (p. 419)

This problem is probably only tangential to the discussion on GMOs in this work. It may be worth noticing however, that the success of the anti-GM campaigners may be partially attributed to the successful imposition of the legal requirement of segregation. This requirement does not change the existing economic and commercial system significantly, but it imposes the expensive development of an alternative one. In order to guarantee segregation, for example, one would need a new parallel system of transportation that would highly increase costs. It would also compromise the possibility of creating partnerships between business sectors, as it would not be convenient for companies involved in more traditional sectors to invest money in a new distribution system. This clearly reduces the possibility to identify shared interests and to then get involved in joint – and for this reason more likely to be effective – social action. In this case then, legal requirements emphasise a status quo and make it non negotiable.

7. There are structuring differences and language difficulties that must be taken into account.

The description of these difficulties reveals a confusing idea of the public. On one hand, Keeney and von Winterfeldt refer to the public as *public groups*, "often represented through various stakeholder groups like Sierra Club, Consumer Unions, League of Women Voters etc.". On the other hand, the authors refer to "most members of the public", an expression that has a significantly different meaning. Both these concepts of the public are summarised in the expression "problem of interaction between agency personnel and the public". This blurring can be very problematic because it makes one thing of two very different agents who have different access to information, policymaking and resources as well as different needs. One of the possible reasons behind this mix will emerge in section 8.4.1, where the PROSAMO brochure is described as an attempt to persuade the public by teaching opinion leaders how to communicate. For the moment, it may be useful to return to the last difficulty identified by the authors. The mentioned structuring differences are associated with the "statutory charge of the agency to protect the environment, health and safety for all members of society". This means that statutory agencies will employ "an analytical structure in which societal options for risk reduction are evaluated by balancing average societal costs, risk and benefits" (p. 419). Problem formulation of public groups, instead, is more focused on single, tangible issues. As to the language difficulties, the authors note the tendency of analysts to use technical and bureaucratic language, which is difficult to understand for "lay people". This requires a change in the way experts communicate risk – a process that is very much seen as one of simplification and translation of technical and bureaucratic language into a manageable terminology.

8. Media sensationalism does not help communicating risk 'effectively'.

Slovic's article in particular makes reference to studies that document the misinformation and distortion caused by media activity. It is also true, however, that Slovic defends the media, acknowledging the difficulties media professionals themselves find because of organisational constraints, competitive issues and the inherent difficulty of risk communication. Given these problems, he suggests that reporters need help in getting reliable information about risk topics and in recognising the best risk analysis from a scientific point of view (Slovic, 1986:11).

9. The complexities mentioned above are magnified by the profound sense of mistrust, the suspicion of hidden agendas and the loss of credibility of institutions involved in the developmentof new technologies. Cases of mismanagement, media sensationalism and past incidents are considered as the causes of distrust.

The proponents of the psychometric paradigm tend to agree on these problematic issues of risk communication. Yet, it is not yet clear what risk communication is trying to achieve.

First of all, according to the authors it is necessary to improve the public's level of information and its ability to interpret risks – so that they can "make more educated decisions" – by:

1. Putting risk into perspective: this means for example comparing risks from a variety of sources and communicating a wide range of these comparisons so as to allow people to choose those that are relevant for them.
2. Making people understand the complexities of risk problems: this refers to the previous discussion about people's presumed "need for certainty".
3. Make people understand the value of information in risk regulation.

The last two objectives are more related to long term educational programmes, particularly in school. Long term strategies must be complemented with short-term ones. The following are possible means to better inform the public:

1. Improving the presentation of information about risks, possibly by avoiding the use of highly technical language and by employing simple visual aids.
2. Improving the interaction with an appropriate selection of the communicator, one that inspires feelings of empathy, honesty and clarity.
3. Employing less direct strategies, such as educating the people who will transmit information to a wider audience.

All these actions must be understood as the means to achieve the deeper objective of improving the societal risk management and the environment, health and safety in society.

### 8.3.1 Summary

To sum up, according to the psychometric approach the problem of public acceptance of scientific and technological innovations is not simply a matter of more communication, but also of better communication. The reason for including a more detailed description of the psychometric paradigm stems form the fact that it represented an important framework with which some institutional actors thought about the problem of the release of genetically modified organisms into the environment. The psychometric tradition provides a more sophisticated problematisation of communication of risk. It is true that it is clearly dominated by the underpinning assumption that what constitutes good knowledge is mainly the one coming from professional experts. But in this case communication is not just filling a gap of knowledge through a flow of information. The flow of information follows an unsafe path made of distortions. Communication must develop devices to overcome the possible distortions occurring within the process of transmission of scientific information about risks. Deficiency still constitutes an important determinant of the public's attitudes, but communication also needs to deal with the distorting elements that prevent the gap to be filled. These elements include media sensationalism, the mistrust of the public[62], and the inherent complexity of dealing with risk issues. This approach, which had great visibility in the US, proposes to solve the problem of risk acceptability: (i) by suggesting to scientists to establish a closer and somewhat paternalistic relationship with the media; (ii) by making explicit the difficulties and uncertainties associated with the analysis of risks; (iii) by training the representatives of various interest groups and organisations who populate the public domain in order to outflank public mistrust by presenting the relevant information from a valued source.

From the observations above, it seems clear that questions on trust reveal a strong interest in a deeper knowledge of the social order, besides the knowledge of the natural order. The psychometric research thus represents an adjustment in the social knowledge, an adjustment that inspires new practice (see Barnes, 1988:53; see also Chapter 2 on the discussion of the Eurobarometer 35.1). As a consequence, the institutional actors examined so far can be said to have undertaken a process of social learning and in doing this they have changed their own social practices and their way of dealing with the world and other actors. These changes can be observed when looking at Boulter's position paper, which is reflected in the PROSAMO brochure. They may also explain why the publication of the brochure was so delayed. The process of social learning took time and the booklet should be interpreted as one of its outcomes.

[62] Mistrust in this case is caused by the negative impact of past accidents.

## *8.4 Applying the Psychometric Model to Genetic Engineering*

The previous section explored some of the features of the psychometric research, which shows that many factors – such as familiarity/unfamiliarity of risks, their catastrophic/chronic and immediate/delayed effects, the dread factor – are used to evaluate the utility of a risky activity. On the basis of these attributes, each individual judges if a risk is acceptable or not in order to maximise the benefits. While acknowledging the existence of non-rational elements that cannot be quantified in human decision making, this approach considers humans' action individualist and rational from an idiosyncratic point of view. Factor analysis reduced the attributes initially identified to two major dimensions: familiarity/unfamiliarity and dread/non dread. Risks can then be ranked within a two dimensional graph: familiarity (the cognitive dimension) and dread (the emotional dimension). Thus, even though acceptable risk is not quantifiable, it can nevertheless be ordered to see what is more or less acceptable according to reasonable (if not rational) individual preference ordering, meaning by preference ordering the ranking of all possible outcomes in accordance to one's preferences.

As seen, the psychometric tradition became part of the cognitive baggage of those industrial and public scientists who were thinking about communicating biotechnology to the public. The most interesting example, which will be now examined in detail, is the draft discussion paper *The Public Perception of Science Using Genetic Engineering (g.e.) as an Example*[63], written by Professor Boulter, a molecular biologists at the University of Durham who became interested in risk perception towards the end of his career. This document is clearly an attempt to find ways to modify the individual preference ordering that makes risk acceptable or unacceptable. According to the author, "the public's perception of risk is governed not by hazard itself, of which is usually ill informed, but by a reaction called 'outrage'". Boulter is not very clear in defining outrage, but one should think of it as the emotional reaction

[63] Unless specified, all the quotations in this paragraph will be taken from this report. For a more developed treatment public perception of risk by the same author, see Boulter (1995)

determined by how risk attributes are perceived by the individuals. The table below shows the list of risk attributes which can be seen as the "components to outrage", which is "real, can be measured and can be managed", as media normally do. The left column reports the risk attributes listed by Boulter as "identified by social scientists, PR experts, etc." and in line with the psychometric tradition. These attributes are organised in dichotomies where the left element produces a reduction in the perception of risk, while the right one determines an increase. The right column reports the actions suggested by Boulter in order to reduce public perception of risk and make genetic engineering acceptable. These actions should help the reader to better understand the meaning of the dichotomies in the left column.

**Table 8.1**

| ***Risk Attributes*** | ***Actions Proposed by Boulter*** |
|---|---|
| Voluntary vs. Coerced | “Be open, e.g. Having got permission to set out test plot, explain to local authorities, local farmers, local supermarket, etc., get them involved and make it a voluntary risk” |
| Natural vs. Artificial | “[...] explain that man has 'interfered' with Nature for a long time as a farmer in order to feed and clothe himself,etc.” |
| Familiar vs. Unfamiliar | “Do not say “there is no risk” - the publics reaction to that is disblief. Tell the public we take risk seriously. Make the risks and benefits clear by information”. |
| Non-memorable vs. memorable | “[...] analyse what makes the risk memorable – then bring it out into the open, even if it has nothing to do with the matter in hand. You often see this technique used in TV symbolism.” |
| Non-dreaded vs. Dreaded | “Acknowledge the dread – don't scoff, accept that it is understandable to have the dread even when irrational”. “[...]factual information will not solve the problem”. |
| Diffuse vs. Concentrated | “Take containment controls [...] very seriously and have plans ready if escape occurs [...] if the worst happens we have made it less dangerous, i.e. more diffuse” |
| Knowable vs. Undetectable | “Never say there is no risk, another expert will always say there is risk then you have experts disagreeing, which is very bad. Report a range of likely risks.” |
| Social Control vs. Individual Control | “Don't say 'keep out' of our technology, but involve the public especially in committees” |
| Fair vs. Unfair | “Distribution of risk should correlate with who will benefit. [...] The 'not in my backyard' syndrom will occur if benefits will go elsewhere.” |
| Morally Irrelevant vs. Morally Relevant | “Discuss and treat G.E. As a moral issue. G.E. is right in order to feed the world, but we must not be arrogant and think is our right to 'play God'.” |
| Trusted vs. Distrusted Sources | “Do not ask to be trusted, we have to rebuild trust. [...] Scientists should admit we have made mistakes. [...] scientists have learned from pasts experiences and are employing the precautionary principle. [...] Emphasize accountability – how we are regulated and how we encourage regulation. [...] Some suspect the control of the technology is moving out of the hands of the scientists into those of commerce and industry.” |

| *Risk Attributes* | *Actions Proposed by Boulter* |
|---|---|
| Responsive vs. Non-responsive Process | Be open [...], involve all interested parties including ones thought to be initially anti. Acknowledge mistakes have been made, be non-technical." |

In Boulter's opinion, "scientists have misunderstood outrage, rather than the public misunderstanding the risk". Scientists' mistake has been to "think only about the hazard term of the equation, i.e. hazard equals magnitude of the hazard multiplied by the probability of it happening". The problem is that risk perception depends also on emotional reactions expressed in outrage. Therefore, what the institutions need to do is to manage outrage in the appropriate way, as "at the moment other 'interested parties', e.g. media" are already doing, particularly because at the moment, in his own words, there is "[N]ot a problem specific to G.E., but is to do with a lack of public confidence in science in general". This means working on the emotional side of risk definition, more than on the cognitive one. Actually, what becomes important is to make scientists and scientific knowledge important again through this emotional manipulation.

The concerns expressed by Boulter are well summarised by the fax introducing the paper and sent to Laslie. The following is a revealing extract of the letter:

> Dear Jim,
> Further to our telephone conversation I enclose a discussion paper on the public's perception of Genetic Engineering, which I prepared for the AFRC Think Tank, which is starting to address the question of public perceptions. It would appear that public concern exists about the openness of scientists and about possible environmental damage, both of which can be readily addressed by information suitably presented. It is the question of how to convince the individual member of the public that he/she would directly benefit whilst not shouldering an unfair share of the risk, that I find more difficult to approach, e.g. Bovine growth hormone and herbicide resistant plants, leave many people sceptical about the benefits of Agricultural Biotechnology. If one can do that, then

> the public would be supportive rather than as at present somewhat negative.
>
> I would be interested in your comments, and those of Unilever's Communication Officer you mentioned – especially as to how.

These few lines confirm that public perception was becoming an important issue because scientists, independently from their institutional background, had serious doubts about the level of trust the public had in them. It also confirms that what mattered was not simply information, but "information suitably presented" in order to operate on the emotional level of people's experience. It is clear from the analysis of Boulter's contribution that "information suitably presented" does not simply refer to the way scientific information should be presented, but to the surrounding context as well, which provides other kinds of information. Cognition clearly is not the name of the game, in the sense that the objective is not to convince people through education, but to convince them that the information provided is trustworthy. This could be done, it is claimed, through the manipulation of the emotional level. To better understand this point, one can think of a kid that has done something bad and promises he will never do it again after a heavy scold. He will hardly appear convincing if his apologies are not combined with certain visible moods, like crying desperately and showing "real" sorrow. In a similar way, it is not enough for scientists to say that there is no risk and that X amount of Y has a 0.03% possibility to affect our immune system or our environment. In order to be credible, such claims must be combined with other elements, because information as such (as if it were possible to have information without connotations) is not a sufficient convincing element. Even technical information must be properly presented, decorated, supported by communicative elements beyond the technical message.

Boutler's fax, however, introduces a new element in this analysis. It is not just said that emotional manipulation needs to take place, but it also suggestes how this should be done: by involving the marketing and PR experts with the appropriate communication skills in the process. Indeed, Boulter is interested in the comments of "Unilever's Communication Officer – especially as to how" biotechnology should be communicated. In other words, the need to have an effective communication at the emotional level is met by a very specific form of expertise, that of the experts in marketing and public relations. All this evidence suggests that the communication of biotechnology seems to depend upon two different kinds of resources: the cognitive resources from the psychological research which give indications about what the public is and needs; the operative resources that are embedded in the PR departments of the companies involved in GM work.

That PR and marketing people became involved was already clear when section 8.1 described the need for a new LINK programme on communicating biotechnology felt by scientists working both in the public and private sectors. As seen, Unilever's Public Affairs Manager, Chris Bunting, was at the centre of these discussions about the new LINK programme. But there are other documents from Unilever's archive showing that PR and marketing experts were considered essential. On July 1st 1991, for example, Byrnes sent some interesting notes to Dr Little – Head of Research – suggesting the need for a study group (which would become the Unilever Biotechnology Working Party, established in October 1991 with Byrnes as chairman) with strong representation from External Affairs. What follows is an excerpt from the notes:

> My views are
>
> - That something needs to be done with some urgency, in the field of Biotechnology – with a strong External Affairs content – at the Corporate level.
> - That it is not obvious what to do. We therefore need a Study or Appraisal to decide the way to go.
> - That, whichever way we go, we will end up requiring a Corporate Steering Committee structure, embracing Product Groups, Research Division and External Affairs, both to execute the chosen external strategy and to ensure effective internal co-operation.
>
> […]
>
> Assuming that we have an effective Research and Development programme which produces the products, two things could stop us getting them on the shelves.

- Legislative Controls
- Public Anxieties

As has been pointed out, the case of irradiation, shows that solving the first by no means solves the second. Indeed, any Government action suggests that there is cause for concern, and provides a rallying point for Interest Groups. Both the Legal and Public anxiety barriers are Public Affairs issues, as well as technical issues.

On either the Legislative or Public Anxiety fronts, inaction will allow the Interest Groups, activist and lobbies already in the field to carry the day. The conventional PR wisdom that action is required before views are formed or fears crystallise, applies. Casual acquaintance, through the media, suggests that we are already losing this battle in the public mind.
[…]
From a communications point of view, a blatant, high profile, compaign [sic] could as easily alarm as reassure the public.
[…]
A study group could

- Establish the position inside Unilever
- Confirm the technical and marketing potential
- Refine current trends in legislation, Interest Group organisations and popular perception
- Examine the alliances with Trade Organisations and other companies most likely to be effective
- Examine alternative communications strategies, to the general public and the appropriate Unilever structure to pursue them.

Also interesting is an undated document from Unilver's Biotechnology Working Party, which is quite explicit on this issue. The document is the result of a meeting between Chris Bunting, Steve Hughes, Head of the Biotechnology Unit, and Richard Fisher, Sales and Marketing Services Manager at Plant Breeding International. When this meeting actually took place is unclear, but probably between 1991 and 1992. Indeed, the Biotechnology Working Party did not exist before the 1991, and the document still talks about ICI, which became Zeneca in 1993. Besides, the documenttalks of Plant Breeding International as a recent acquisition, which took place in the late 1980s. The following quote is quite important for the argument that is put forward in this thesis:

> [...] PBI sense a difficulty with insensitivity to consumer wants. Three new technologies, BST, pig hormone treatment and food irradiation, have failed because of this, and there is a desire for a greater input from the marketing and PR sides of business at an earlier stage in industry's representative efforts.
> [...]
> PBI has an interest which coincide with other plant breeders at present, but this will not necessarily last. While invasive biotechnology remains unproven, there will be no problem in putting a united case, but once genetic engineering results in a specific variety available for commercial use, unity will become more difficult. ICI, for example, are more experienced in breeding for a pharmaceutical end (where patent legislation is different, and where, for example, the yield characteristic is less important and the product is not self-replicating).
> However, this divergence should not prove difficult for 5-10 years and, in the meantime, value is seen in building links with, especially, ICI, CIBA-GEIGY and Nestlé. Pooled resourcing of communication costs and programmes is supported.

The document goes on identifying the priorities for Unilever, the following being particularly interesting:

> Accept biotechnology as a corporate problem with commercial applications, and involve marketing people (e.g. Jespen, Foods Executive) in the policy process. Treat biotechnology as a commercial problem, not as an esoteric issue. In so doing, accept the need to apply communication skills so that the safety and efficiency of biotechnology is properly expressed and the science is not hampered by legislation, thus diminishing its benefits.

To sum up, it is clear that dealing with the issue of public perception of biotechnology involved the use of different kinds of expertise and cultural resources, among which the culture of the marketing world played an important role. One can find the convergence, the merging and the interaction of these cultures in the PROSAMO brochure, which constitute a very interesting example of communication of biotechnology.

Before going on with the analysis of the brochure, I would like to specify a couple of points. First, I do not argue that Boulter's suggestions have been followed literally. I am simply arguing that the ways of interpreting the relationship between science and society in PROSAMO and in the new LINK programme were very similar because of their overlapping membership. From this point of view, it is reasonable to assume that the psychometric approach found fertile ground within PROSAMO. The consequences are significant from a communication point of view and it is worthwhile to interpret the brochure also in light of the psychometric perspective. Second, I would like to emphasise that, in light of the previous chapters, this process of convergence should not appear very surprising. One of the effects of Thatcher's science policies was that of drawing the scientific community, especially certain specific sectors, and the industrial world closer together. The government's approach towards science pushed the universities to operate within the logic of the market and to establish something like a business partnership with more traditional companies. At the same time, the government's explicit attacks against the autonomy of science stimulated a new form of interaction between scientists and those companies which needed the authority of science in order to make credible claims. Thus, if on the one hand it is possible to see academics seeking legal advice to establish favourable forms of partnership with companies, on the other one can also see important parts of the industrial sector jump in defence of science as an authoritative source of information. It should not be surprising that this defence also implied the reliance on the communicative practices permeating the business sector, those developed within PR and marketing departments.

### 8.4.1 The PROSAMO brochure

As mentioned, the end of 1993 signals the conclusion of PROSAMO with the publication of a brochure aimed at the well educated but ill informed public. A

Unilever interviewee (U2) told me that the brochure was not really addressed to the general public, but to interest groups, like consumer groups or women groups[64]. This was also confirmed by S1, and is in line with the communication approach suggested by psychometricists in the sense that through this brochure, the PROSAMO companies were trying to 'educate' "the people who will transmit information to a wider audience". This was done through a communicative approach that integrated different styles: for example, as it will soon become clear, the brochure blends scientific language with advertising techniques. This approach was not simply meant to directly persuade the representatives of interest groups. Actually, the impression is that the real intention was to teach them how to communicate to their audience through a concrete example. In order for the brochure to be effective, the "appropriate selection of the communicators" was perceived to be important as well. In a fax introducing a draft version of the brochure, sent to some of the members of PROSAMO for comments, Jonathon Thomas describes the author of the brochure (David Fishlock) as a reputable, ex-Financial Times journalist.

From a textual point of view, it is not difficult to distinguish in the brochure the different cultures discussed earlier – science, psychology and PR. Scientific information constitutes an important part of the work, but it is clearly integrated with other elements which are aimed at operating on the emotions of the reader. This emotional manipulation takes place at both the verbal and the non verbal levels.

The PROSAMO report starts with a basic and very interesting question around which the whole text is hung: "Can we secure the benefits of plant gene technology without environmental damage?". Different elements suggest that this question plays a key role within the text. For example, it is placed at the beginning, right below the title, a privileged position that make it readable even by those who are not going to read the whole report. Moreover, it is close but still isolated from the rest of the text body, suggesting that the following paragraphs should be related to it. Finally, it is written in bold font, confirming its importance in framing the meaning of what will follow. These para-textual

[64] The inclusion of women groups should not be surprising since it is often women that do the shopping for their families, and especially for their children. Especially in the case of food it was important to have the mothers' support.

elements give good reasons to take a more critical look at this question and to explore its features in greater detail.

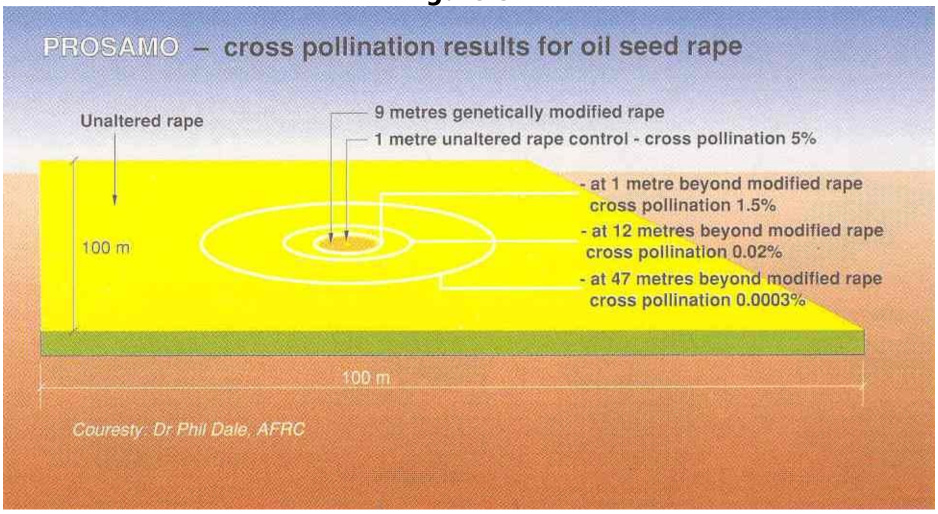
#### 8.4.1.1 Orienting the reader

What information can be obtained from the way this question is expressed? I would first of all focus on the words “secure the benefits”. Benefit, according to the dictionary, means “something that aids or promotes well-being”. But well being is a condition of human beings that depends on a multiplicity of factors, which are connected to each other. For example, a new drug may considerably improve one’s health, but if this drug costs three times more than its predecessor and for this reason someone needs to give up visiting her or his beloved nephew who lives 300 miles away in order to compensate for the added expenses, then his or her well being will hardly improve. Thus, when we talk about the benefits of plant gene technology, we mean that either (i) the introduction of this new technology do not influence any of the other elements contributing to our well being or that (ii) its introduction influences the other elements of a given situation in such a way that the sum of the perceived advantages is higher than the sum of the perceived losses. The implications of this second point are particularly important to both understand the second part of the question and to frame the rest of the text. The fact that someone is wondering if “we” can “secure” the benefits of plants gene technology means that she or he has already compared the old (or present) situation with a new (or coming) one and determined that the new technology brings more advantages than disadvantages or improves an element of ‘our’ well being without affecting the others. These given-for-granted benefits throw light on the extent of environmental damage. Indeed, “environmental damage” seems here to be considered an acceptable side-effect, the acceptability of which is determined by a scientific investigation. These considerations are supported by the title and subtitle of the brochure: “Environmentally Safe Crops for the Future: Testing the Environmental Impact of Plant Gene Technology”. That is to say, genetically modified crops are safe, and this safety is proved by scientific tests.

### 8.4.1.2 The use of science: familiarity and knowability

The relevance attributed to scientific investigation is beyond doubt. At the end of the first page it is explicitly stated that "experimental tests are the only way of addressing public concerns". At least half of the report consists of a technical description of the experiments and their results, and it is supported by the figure reproduced below:

**Figure 8.1**




These descriptions and images are clearly supposed to show that risks have been considered seriously and that proper action has been undertaken in order to reduce the environmental impact of biotechnology – ""It was quite clear throughout the setting up of PROSAMO that the companies wished to demonstrate their acknowledgement of public concerns over releases, through funding the research" recalls Dr Roy Dietz, the senior DTI scientist heading the Biotechnology Unit when the programme began". Evidently, this is also a way of dealing with the dichotomies *familiar v. unfamiliar* and *knowable v. undetectable*.

It is true that providing technical data in texts dealing with science may have various purposes. For example, one could consider technical data as the details of a description and therefore important tools, as Jonathan Potter underlines in *Representing Reality* (1996), to build up the facticity of an account. In other words, technical details may be important to make the reader build a simulacrum of someone who actually witnessed the experiments. Novelists often rely on detailed descriptions to make story believable. Technical descriptions, then, would make the scientists believable as direct witnesses of the events reported. Unfortunately the use of technical data to create the facticity of an account is only effective when the source of information is already credible, that is, if the reader trusts the person describing to tell the truth. But this is exactly the problem that the PROSAMO scientists were trying to solve, appearing credible dispensers of trustworthy information when they thought they were not. And indeed, in the booklet the provision of technical information is supported by a series of rhetoric strategies aimed at improving the credibility of the scientists providing it. So it is correct to say that scientific information is what is needed to reassure the public and that this knowledge needs to be transferred to lay people, but delivering information is not enough. One needs also to take care of how the information is delivered. This means dealing with the other important attributes identified by the psychometric research.

#### 8.4.1.3 The natural and the moral

As a reply to the *natural vs. artificial* dimension, the human being is explicitly presented as an active agent entitled to manipulate the natural world and to affect the environment, even accepting some risks, if this means a general improvement of humans' conditions. This was already implicit in the initial question, but in many instances the PROSAMO report makes clear that the relationship between human beings and nature has always been artificial and that humans have manipulated and modified the natural world for ages, by selecting for example the most promising plant varieties. Actually, it is said, the new technology allows greater precision than traditional breeding methods.

> Plant scientists are doing only what the traditional plant breeder has done for aeons, often with spectacular success in the productivity and nutritious value of crops. The new plant gene technology can do it faster and more predictably.
> […]
> Remember, such commonplace species as potato are not native to Britain but were imported, in this case from South America, and have

> been honed over the centuries by breeding to the specialties we eat today. (p. 2)

If this was not enough, the brochure deals with the *moral vs. immoral* dichotomy by introducing the moral theme "feeding the world". In other words, the tension to the moral dilemma if it is right or wrong "to play God" is resolved by switching the frame of morality from one level to another – that is, to the sacredness of human life. There are fundamentally two topics here that are used to drive the reader's opinion. First of all, as seen, the brochure proposes to look at the environmental impact of GMOs not as damage but rather as a change that is part of the instrumental relationship between human beings and the natural world. This process may involve risks (the assessment of which will be determined by science) but also advantages. Once the problem of the environmental impact has been devalued, the reader is implicitly invited to compare it with the condition of the people in the Third World, evidently suggesting that environmental implications are less relevant than the human lives that could be saved through the new technology. This is an interesting example of reframing of the moral impact of biotechnology. The world dimension is introduced on page 2, where it is said that "pests and pest borne diseases still ravage crops in many parts of the world. The scientists planned to identify genes that conferred pest-resistance in one plant and transfer them to the threatened crop". It is towards the end that it is explicitly claimed that "the Prosamo results add greatly to confidence that the new plant gene technology can help to feed the hungry world".

#### 8.4.1.4 Fairness and social control

The *hunger* theme leads towards another problem. The questions one may ask is: how can we be sure that this technology will be employed to improve the conditions of humanity? How can we be sure that industry will not benefit from this technology at a loss for normal people in terms of environmental consequences? This is the problem of the *fair vs. unfair* distribution of risk, which is closely connected to the trustworthiness of the sources of information. If individuals perceive that the majority of the benefits will go to someone else in the face of uncertainty, then what Boulter calls the "not in my backyard syndrome" (NIMBY) will occur. Apparently, the best way to reduce the perception of unfairness and thus the distrust of experts has been judged to be the presentation of the experiments as the product of a joint initiative between political organisms, industry and independent academic research centres. Thus, "the largest experiment has been conducted over the last three years in the UK, in a collaboration between Government and industry, who defined the scientific mission, and public-sector researchers, who had a free hand in carrying out the demanding work". The combination of these three different social actors playing within different, although interconnected, contexts has the objective to represent an equilibrium of interests which should guarantee than no particular interest will prevail in the definition of the developmental agenda. The figure below, taken from the brochure, is an attempt to represent this equilibrium in visual terms.

**Figure 8.2**


PROSAMO
Advanced Technologies (Cambridge)
Agricultural Genetics Company
Ciba Geigy plc
Du Pont (UK)
Hoechst
Zeneca (formerly ICI)
Monsanto Europe
Plant Genetic Systems (Belgium)
Shell Research
Unilever (UK)
Participating COMPANIES
DTI
AFRC
FUNDING BODIES
BUDGET
£1.5 million over 3 years
RESEARCH ORGANISATIONS
Microbial Programme
University of Essex
University of Aberdeen
Plant Programme
University of London (Imperial College)
AFRC Institute of Plant Science Research (Norwich)

#### 8.4.1.5 The non-verbal level

The content of the brochure is supported by its aesthetic dimension. In the first page, for example, the main body of the text is inserted within a background image of a stylised landscape resembling a hill cultivated with oilseed rape (see ANNEX I). The colours are sharp, well characterised and uncontaminated by each other, thus in line with the message of the brochure that GMOs will not be invasive and disruptive. It is really an image of an environmentally perfect situation, proposing a good balance between cultivation/culture and nature. The rounded lines reinforce this sense of harmony.

The figure of the plant on the left is a very interesting element too. The neutral colour of the plant, with the exception of the flowers which are bright yellow, reflects the minimal and very precise modification that humans can produce in plants through genetic engineering, a concept already expressed verbally. This modification is not bound to modify the equilibrium that can be found in the background. It is actually consistent with it.

Other visual characteristics are relevant. The pictures on the last page of the scientists who undertook the work, clearly constitute an attempt to be reassuring. These are people that come into play personally, with their own face and dignity. Of course, there are resemblances with the usual ads featuring an expert in a white coat giving advice. But in this latter case the figure of the expert is used to sell a product, while in the case of PROSAMO the expert and his claims are the product. In order for science to be accepted as a product, its communication had to abandon any prescriptive character to find legitimisation in a wider moral framework (see also PROSAMO, 1991).

## *8.5 Fuelling Distrust?*

From the analysis so far, this seems a kind of communication which aims at convincing people about the safety of genetic engineering by persuading them, through the instruments of marketing, of the trustworthiness of scientists and of the information they produce. The PROSAMO brochure is clearly an attempt to rebuild trust and public support in science through a policy that explicitly focuses on appearance. Appearance should be interpreted here in two senses. On the one hand, it refers to the actual image of science. In otherwords, certain rhetoric devices – the reframing of genetic engineering and of the PROSAMO experiments from within an acceptable moral framework and the presentation of science as an independent institution – are used to improve the public image and credibility of science and its practitioners. On the other hand, it literally refers to the figurative dimension. The visual organisation of the brochure follows faithfully and provides support to what is expressed verbally. In this strategy, one can clearly see the persuasive character of this kind of communication – a style, however, that differs significantly from the usual communication of science.

Bucchi (2004), for example, interestingly shows how science communication in normal conditions tends to follow a certain pattern[65]. Following Cloitre and Shinn (1985), Bucchi claims that in general communication of science can be conceived as a continuum that contains four basic stages: intraspecialistic, interspecialistic, pedagogical and popular. In the journey from the intraspecialistic level to the popular one, the science that is communicated undergoes a series of transformations. The continuum is represented in a funnel-shaped mode. In Bucchi's (2004) words:

> The *continuum* is funnel-shaped to emphasize a property that several scholars attribute to the process, namely that the more one scientific result distances itself from the core specialist context ('the research front') and precipitates towards the public level, the more it becomes stylized, stabilized, apodictic and unquestionable (Whitley, 1985; Collins, 1987; Latour, 1987). At the popular level, doubts and disclaimers disappear: the distinctions and nuances of specialist knowledge condense into elementary and compact formulas: AIDS is HIV, psychoanalysis studies 'complexes', the neurological theory that hypothesizes a division of tasks between the two hemispheres of the brain is transformed into a sharp antithesis between 'right-dominated' and 'left-dominated' people. The communicative path from specialist to

[65] A more detailed discussion about the different approaches to science communication can be found in Bucchi (1998).

> popular exposition removes subtleties and shades of meaning from the knowledge that passes through the funnel, reducing it to simple, certain and incontrovertible 'facts'. (p. 272)

It is clear that in these normal circumstances the communication of science does not have a persuasive character, in the sense that the truthfulness of science is never questioned. When science is described in terms of truth, it is devoid of any social character and therefore it does not need to be sustained by morality. Morality is taken for granted. On the contrary, the PROSAMO brochure explicitly introduces a moral character in the description of the science and the activity of scientists needs to be justified on moral grounds. In other words, one can witness a move from an apodictic to an apologetic science communication.

The analysis above is very interesting because it unambiguously contradicts the nowadays prevalent picture of the way dominant institutions use science in their relationship with the wider society. This account, put forward by scholars like Beck and Wynne as seen in Chapter 2, argues against an approach to public communication of science that is said to be widespread among dominant institutions and is described as a diffusionist-pedagogical-paternalistic approach (Bucchi, 2004). This diffusionist conception of science communication would focus on the provision of scientific information as the only way to overcome public opposition towards science and technology. The critics of this kind of model deprecate its sole focus on the level of scientific literacy, an exclusivity that tends to neglect the local, contextual aspects of human knowledge. This argument is frequently made also in the case of biotechnology and GMOs. But the analysis in this thesis has actually shown that institutional communication of GMOs moves away from the simplified picture of the diffusionist model. Cognition is clearly not the name of the game anymore. Successful communication – that is, communication that creates public support – needs to combine a cognitive and an emotional manipulation of the audience. It is true that Boulter, in his contribution, speaks of "information suitably presented", but it appears clear that scientific information plays a rather marginal role in the suggestions he provides. And actually, it is very interesting to notice that Boulter's suggestions are not that different from what Wynne et al. (2002) proposed ten years after, as a result of their already mentioned PABE project. In the report of the project, Wynne and his team list a series of actions institutions should follow in order to restore trust:

In order to restore trust, institutions would need to demonstrate their capacity for adequate risk management of risks through consistent behaviour over a long period, and across different fields (not just GMOs), by, for example:

- Admitting past errors.
- Admitting that they don't always necessarily know best.
- Admitting uncertainty, and explaining how this has been taken into account in decision-making.
- Utilising input from all relevant sources (not just scientific experts).
- Being transparent about *how* decisions are made, including explaining how different interests, risks and benefits have been balanced against one another.
- Imposing heavy sanctions in cases where mismanagement or fraud is identified.
- Overall, demonstrating that views of the public are understood, valued, respected, and taken into account by decision-makers - even if they cannot all be satisfied[66].

The similarities with Boulter's proposal is striking and can be summarized with the following table:

[66] From the summary of the report available at http://www.lancs.ac.uk/depts/ieppp/pabe/docs.htm, page 9.

**Table 8.2**

| Actions proposed by Boulter | Action proposed in PABE |
|---|---|
| "Be open, e.g. having got permission to set out test plot, explain to local authorities, local farmers, local supermarket, etc., get them involved and make it a voluntary risk" | "Being transparent about *how* decisions are made, including explaining how different interests, risks and benefits have been balanced against one another" |
| "[…] explain that man has 'interfered' with Nature for a long time as a farmer in order to feed and clothe himself, etc." | |
| "Do not say "there is no risk" – the publics reaction to that is disbelief. Tell the public we take risk seriously. Make the risk and benefits clear by information" | "Admitting uncertainty, and explaining how this has been taken into account in decision-making" |
| "[…] analyse what makes the risk memorable – then bring it out into the open, even if it has nothing to do with the matter in hand. You often see this technique used in TV symbolism." | |
| "Acknowledge the dread – don't scoff, accept that it is understandable to have the dread even when irrational". "[…] factual information will not solve the problem." | "Overall, demonstrating that views of the public are understood, valued, respected, and taken into account by decision-makers – even if they cannot be all satisfied". |
| "Take containment controls […] very seriously and have plans ready if escape occurs […] if the worst happens we have made it less dangerous, i.e. more diffuse" | "Admitting uncertainty, and explaining how this has been taken into account in decision-making" |
| "Never say there is no risk, another expert will always say there is risk then you have experts disagreeing, which is very bad. Report a range of likely risks." | "Admitting uncertainty, and explaining how this has been taken into account in decision-making" |
| "Don't say 'keep out' of our technology, but involve the public especially in committees" | "Utilising input from all relevant sources (not just scientific experts)" |
| "Distribution of risk should correlate with who will benefit. […] The 'not in my backyard] syndrome will occur if benefits will go elsewhere." | "Being transparent about *how* decisions are made, including explaining how different interests, risks and benefits have been balanced against one another" |
| "Discuss and treat G.E. as a moral issue. G.E. is right in order to feed the world, but we must not be arrogant and think is our right to 'play God'." | |
| "Do not ask to be trusted, we have to rebuild trust […] Scientists should admit we have made mistakes. […] scientists have learned from past experiences and are employing the precautionary principle. […] Emphasize accountability – how we are regulated and how we encourage regulation. […] Some suspect the control of the technology is moving out of the hands of the scientists into those of commerce and industry." | "Admitting past errors; admitting that they do not necessarily know best; admitting uncertainty, and explaining how this has been taken into account in decision-making; being transparent about *how* decisions are made, including explaining how different interests, risks and benefits have been balanced against one another" |
| Be open […], involve all interested parties including ones thought to be initially anti. Acknowledge mistakes have been made, be non-technical". | "Admitting past errors", "Utilising input from all relevant resources (not just scientific experts)". |

It seems therefore that when moving from the analytical domain towards some practical considerations about science communication, Wynne and colleagues do not propose anything really new and viable. One, at this point, could wonder why this is the case. My impression is that Wynne and associates have actually focused on other kinds of initiatives that should follow traditional communication campaigns and that, in line with their emphasis on the local context, can involve only a limited number of people (Wynne, 1989). They pay very little attention to the communication taking place in the mass media, which still play a big role in risk, and more generally science communication. From this point of view, it is probably the case that disregarding the needs of local communities may have increased distrust of dominant institutions, including science. But this is however only part of the story, as it does not explain the scepticism towards GMOs beyond the local context. At a mass society level, McQuail (1975, 167) teaches that communicators and their audiences tend to have a stereotypic image of each other, a stereotype to which certain expectations are attached. Communicative genres guarantee that these expectations will not be betrayed. Genres are indeed well established, institutionalized forms of communication that the audience tends to know very well and rely upon in order to make sense of the world[67]. From this, it follows that if the style of communication changes, then even the audiences' expectations may change. In the specific case of PROSAMO, the move away from a more standard format of popular science communication may have had important implications in the public reception of scientists' knowledge claims. Of course, it is difficult to generalise from a single case like PROSAMO. But although more research on communication of GMOs is needed to make more definitive claims, there are good reasons to think that the kind of science communication characterising the PROSAMO initiative was part of the set of ideas about the public that this chapter has shown to have been quite widespread among dominant institutions. If this is really the case, then with a public used to having science communicated in an apodictic way, it is no surprise that an apologetic style may raise concerns within the audience.

Actually, the explicit introduction of the moral dimension may well have accentuated the problem that has been identified in the previous chapter: that the emphasis on the process of modification allowed the focus to move from the characteristics of the products to the undesirable social consequences of

[67] On genres see Martin (1985) and Swales (1990).

the monopoly by large multinational organisations over this process. While PROSAMO, as a large scale scientific experiment, could potentially require high standards of evidence for criticism, its explicit foundation on the moral dimension may have further opened the science behind it to a wider range of criticism, which also tend to be more widespread and intense than narrowly technical disagreement. For example, a fair criticism to the 'new Green Revolution' rhetoric can be found in Paul Richards (2005). As an anthropologist, he closely studied rice farming in poor and unstable areas of West Africa[68]. He claims that local farmers' practices have been able to provide food security in poor areas afflicted by civil war by adopting African rice, a variety of rice that is more resistant than other varieties and requires less chemical input and is therefore suitable where good land is scarce and labour lacking. The needs of the poor farmers have instead been disregarded by Western plant breeding programmes, which dismissed African rice due to breeding difficulties and poor harvest characteristics in favour of Asian rice. He also argues that poor rural farmers, through their activities, may actually have managed to develop new rice varieties that are hybrids between African and Asian rice. This suggests that if reduction of Third World hunger is the objective of current plant biotechnology research programmes, rich countries need to abandon a quantitative, positivist and neo-liberal approach to biotechnology innovation – founded on a genetic blueprint model – to focus instead on "how poor tackle their own food security (how **indigenous technical knowledge** is formed, how **people's science** is practised) in real-life contexts, and aligning scientific inputs with existing local approaches (with the **agency of the poor**) [emphasis in the original]" (Richards, 2005; conference slide).

Richards' concerns are shared by others in the anthropological literature. In her introduction to *Food in the Social Order*, Douglas stresses how few works on the social uses of food have been produced in order to help policy makers and administrators to meet the poorest people's needs. She acknowledges that food policy should not be merely concerned with food production and physical nourishment, but even with the analysis of domestic and local organization. Of course, local food systems need to be understood in the context of their

[68] See also Richards (1986, 1989, 1990, 1996). For an interesting interpretation of the failures and success of the Green Revolution see also Griffin (1979), Lipton and Longhurst (1989). For further work on poverty reduction strategies and agriculture see Reece (1997).

relationship with family institutions and of the latter with larger social institutions of the community. And this seems what policy makers and institutions engaged in food policies, for developing countries in particular, have forgotten to take into account. Doing it would have meant to integrate a quantitative approach with political criticism and thus to politicise the subject of food. The politicisation of food is evidently related to the social stratification and to the distribution of resources, which of course are to be questioned. She thus suggests that more effective hunger reducing policies need to consider social uses of food, and to combine this with other social, legal and economic aspects of the food shortage problem[69]. With Western society strategies to tackle poverty increasingly under scrutiny since the 1980s and the increasing visibility of the failures of their efforts to reduce famine in the Third World, the introduction of the moral dimension in science communication about GMOs by dominant institutions may have actually fuelled wider recognition of the fallibility of scientific knowledge and encouraged distrust.

The way scientists have cooperated with marketing experts may have further worsen the situation. Indeed, this chapter has offered good indications that marketing experts worked side-by-side with the scientists in order to improve public perception of genetic engineering. In PROSAMO this cooperation crystallized into the brochure, where an apologetic communication was supported and complemented by the language of advertising, to which people are accustomed and towards which they tend to be suspicious (Moloney, 2005)[70]. This strategy may well have highlighted scientists' lack of independence even more as well as their links to distrusted institutions. In other words, science did not gain much from this dialogue with other cultures.

Of course, this dialogue between different cultures – mainly but not only the cultures of natural and social scientists and PR experts – does not necessarily

[69] In the same volume, Powers and Powers give some evidence of how, despite of their segregation and the power of the 'white' culture, the Oglalas – a Native American community – have been able to express their distinctiveness from the Euro-American culture through the conscious manipulation of food and the rituality connected to it. They conclude that "the process of understanding foods in terms of their position in the classificatory system, as well as the ambiance in which they are prepared and eaten, plays a bigger role in determining what foods will be accepted or rejected than simple attraction for sensory modalities".

[70] An interesting discussion of the pervasiveness of advertising in contemporary society is offered by Holden (2004), a piece that is part of an interesting contemporary compendium on media studies (Downing et al, 2004).

need to be conceived as a smooth process. Although some scientists explicitly sought advice from the PR people, there are important indications that this relationship had its hiccups. U2 for example, when questioned about the brochure, claimed that various drafts were produced, each time going back and forth from the labs and the PR departments of the companies for revision. U2 words summarise well the difficulties emerging in these multicultural interactions. She first emphasises the marketing one as the dominant culture:

> Within Unilever there was a little bit of a thought that scientists can't communicate, that when you need to talk to people, Unilever worried "oh God, scientists are going to come up with some scientific stuff that the public won't understand. We are marketing people so we ought to be able to really look at this and to communicate better to the public. So we should get involved some of our communication and marketing people to help communicate". So there was a little bit of worry that scientists are not going to be able to communicate and therefore we have loads of experts here in Unilever and therefore we should involve them. It was a bit like that.

But the interview also points out the ambivalent reaction of scientists to this approach, a mixture of acceptance and refusal:

> You will find that people like myself, and Nigel and Steve, and you will find others…saying "hang on a minute, we are going to talk to the public because we are the people doing the work, I'm quite prepared to stand up and be counted"…So I think around about the mid '90s we, some of us resolved with talking to the public, and decided that this wasn't working, just getting somebody making a piece of glossy brochure. Just didn't work and then we said…"we need to go out and talk to the public" and so you'll see the sort of things we started with the Royal Society and opening things up and talking to Greenpeace and we realised...I think it was looking at one or two like...ICI produced then a brochure called "Feeding The World" and I pulled my hair up when I saw it, I think it was absolutely utter sheer stupidity what they did. Monsanto brought out this glossy brochure. People were doing it, it was just, it was actually making

> things worse, not better. So the public is not that stupid and it looked so ridiculous. So in about the mid 90s I think the whole thing flipped (in our minds). We said "we're not gonna do this. Scientists need to stand up and be counted, given somecommunication skills but make sure it is scientists not the marketing people". And so a lesson was learned, I'm afraid which was rather, which was very badly taken.

## *8.6 Conclusion*

This chapter has shown the intricate dynamics that characterised the development of PROSAMO as a collaborative project involving industry, the DTI and academic institutions. Chapter 6 has shown that the approval of the first European directive on releases into the environment and the transformation of ACRE into a statutory committee changed the role of the scientists doing work in genetic engineering, at least in the UK, in the decision making process. In short, scientists turned more into bureaucrats and their exclusive ability to produce credible information became rather irrelevant in ACRE's deliberations.

This chapter illustrated that these transformations were perceived by the scientists as a loss of social standing and credibility. This new self-perception had important consequences for PROSAMO, which turned from being an exercise of the authority of science into being an exercise to restore its credibility through a form of communication that combined cognitive and operative resources. The cognitive resources were those provided by the psychometric research tradition, according to which risk perception depends upon certain psychological factors that need to be addressed through a form of communication not exclusively centred on the provision of technical information, including the trustworthiness of the source of information. From this point of view, the credibility of science and technology could be increased by using a communication that worked at the emotional level. PR and marketing people within the companies were thought to possess the communication skills to effectively emotionally manipulate the public. In PROSAMO, the end result of this combination can be seen in the final brochure, in which scientific information is communicated in an apologetic style and supported by a language that recalls advertising techniques.

Although it has been warned to not generalise from a single case like PROSAMO, it has also been argued that there are good indications that the communication of GMOs during the early ‘90s may have been affected by a general strong temptation to rebuild the credibility of science using a policy which explicitly focuses on appearance. This suspicion led to reasonably hypothesise that mistrust in science may not only be a matter of people recognising that scientific facts are less than solid, as claimed for example by Mairi Levitt (2006), but also a matter of scientists being less than confident of their role in society and therefore relying, not without ambiguities, on a new language for scientific communication that sounds too commercial to be trustworthy. Future research may shed light on this point.

# Chapter 9 – Conclusions

It is now possible to draw some conclusions from the discussion in the previous chapters. This discussion started with the intention of offering a different and interesting slant to talk about the GM debate in the UK, following the recognition that there is a historical gap that needs to be bridged. The debate over recombinant DNA technology during the 1970s, both in the UK and USA, has been very well described by Wright (1994). Also, a lot has been said about what happened during the 1990s, particularly in Britain (Levidow, 1994; Tait, 2001; Grove-White *et al* 1997; Marris *et al*, 2002). But very little has been said about the 1980s, long before GMOs became a popular issue. Through a detailed examination of the Unilever archive of the PROSAMO programme, supported by a series of interviews with the individuals who participated in this initiative and through a comparative discussion of the dominant existing accounts of the GM debate – particularly the cognitive and the ethnographic approaches – I have been able to explore the important but rather neglected role of the UK dominant institutions in the historical development of the GM debate. The final result is a work that is both intrinsically interesting from a historical point of view and an improvement in the understanding of why history has developed in a particular direction.

The work of Mary Douglas (Douglas and Wildawsky, 1982; Douglas, 1982, 1987, 1992, 2002) with the support of other scholarly traditions (Barnes, 1974, 1977, 1983; Griswold, 1987), represents the theoretical and methodological backbone of my interpretive effort. This thesis has fruitfully integrated and applied these different schools to make sense of this understudied historical period and to draw connections with the other accounts of the GM debate. In doing so, it has highlighted the explanatory power of applying theory to all the aspects of social life and to all the relevant human behaviour.

This conclusive chapter will try to pull the different topics that have been analysed together. Section 9.1 reminds how different approaches have tried to make sense of the GM controversy and of public negative attitude towards GMOs in the UK and highlights how the approach behind *Uncertain World* has dominated the existing interpretation of the debate and policy discourses in recent years. Section 9.2 shows how important aspects of this approach need however to be questioned, and how Douglas' approach is as a better model for making sense of institutional dynamics. It thus summarises some of the conclusions obtained by employing Douglas' theoretical perspective in the study of PROSAMO. It is emphasised how risk and uncertainty need to be conceived as collective constructs used strategically by dominant institutions in order to pursue various objectives related to the context in which they were operating, as explained in more detail in Chapters 4 and 5, and how the legitimate use of these concepts was bound to the credibility and authority of science (Chapter 6). In 9.3, my observations are contrasted with Levidow's account of the early stages of the regulatory debate, an account that has been discussed extensively in Chapter 2. It also tries to make sense of these differences as the result of a refusal to being asymmetrical in the treatment of human behaviour and of a different interpretation of Douglas' model. In particular, it is emphasised how the approach I have adopted in this thesis has actually stimulated an interpretation of the role of ACRE and of regulation that is more consistent with well-established sociological theories on rule-making and rule-following (Chapter 7). This is further stressed in section 9.4, where Tait's contribution to the current understanding of the GM debate is discussed a bit more in detail. It is shown how she rightly identifies that the role of expertise changes in conjunction with the introduction of the precautionary principle, but in light of the political changes described in Chapter 7, it is argued that she identifies the wrong reasons for this happening. The consequences of these political changes on the social role of the scientists documented in Chapter 8, are summarised in section 9.5. Section 9.6 explains how this work and the approach it has adopted opens up further research opportunities in related areas. In 9.7, it is argued that the method adopted here to make sense of institutional dynamics may actually be fruitfully employed in policymaking as a system of controversy management.

## *9.1 The Debate: Contrasting Accounts*

Various scholars agree that the GM problem has fundamentally been a problem of public perception of risk and of acceptance of a new technology. But the various accounts of the debate have offered different and sometimes conflicting views of public perception based on different ideas of the relationship between technoscience and society. As illustrated by Irwin and Michael (2003), the vision of the relationship between science and society, and this is true also for the GM debate, has oscillated between two poles. On the one hand there is a more traditional way of conceiving the public's response towards science and technology as dependent on the level of its scientific literacy (see also Bucchi, 2003; Bucchi, 2004). The surveys of the Eurobarometer are said to represent such an approach (Wynne, 1996). On the other hand, there is a more dualistic vision of the relationship between science and society in the sense that science and technology tend to be incorporated within local and familiar contexts where other forms of knowledge are important in shaping people's identities. According to this second approach then, public support depends on the ability of dominant institutions to acknowledge and give room in decision making to local identities based on contextual knowledge.

From these two different theoretical perspectives originated two very different ways of studying and making sense of public responses. The first approach finds expression in surveys aimed at testing the level of scientific competence of the public and this is why it has been branded 'cognitive'. The second approach is more oriented towards a qualitative kind of analysis, to the point that it has been named 'ethnographic', even though it does not always result in ethnographies.

In the context of the GM debate, the ethnographic approach (or Lancaster School) finds its first concrete expression in *Uncertain World* (Grove-White et al., 1997) and actually, as already seen, the authors of this report perceive themselves within this conflict between the two perspectives described above and explicitly distance themselves from the traditional survey methods which have been unable to unearth the inner dynamics involved in public perception and acceptance of risk. In line with Beck's (1992) argument, and as stressed by Wynne on other occasions (for example Turner and Wynne, 1993), too much focus on scientific literacy is interpreted as the expression of a dominant ideology that tend to neglect other forms of knowledge.

According to the authors of UW, the dominant institutions should take into account the fundamental role that uncertainty plays in the way people perceive risks. In a nutshell, public's anxiety towards innovation is linked to a widespread, double awareness: that our knowledge is inevitably uncertain and that there are limits to the possibility of managing this uncertainty. Public opposition to GMOs would therefore be due to the contrast between this awareness of the public that human knowledge, including that of experts, is uncertain and an overconfident body language adopted in institutional communication about risk, a communication style that compromises its own credibility.

## 9.2 Beyond UW: the Strategic Use of Risk and Uncertainty

One of the problems about the interpretation offered in UW, as identified in Chapter 2, is that no evidence is provided of the overconfident institutional behaviour in the GM debate. The very fact that UW resulted from collaboration between green movements and Unilever should raise scepticism about its interpretation of the events. As evidence, the authors simply cite the fact that participants in the focus groups drew a connection between the BSE crisis and GMOs. In other words, the BSE is used as an example of the overconfident institutional body language that can undermine public trust. This conclusion is then applied to the GM context, without however offering any specific example.

But Chapter 2 stressed also a theoretical problem in the explanation offered in UW. As noticed, the use of the concepts of uncertainty and risk is problematic. Risk is conceived as a construct that reduces larger uncertainties into manageable entities. The problem is that talking about "larger uncertainties" introduces a scale that by definition cannot be attributed to uncertainty. Uncertainty is indeed defined as the possibility of an event happening with a probability that cannot be determined (Knight, 1971). This way of treating uncertainty, therefore, does not make it very different from the concept of risk that is criticised.

Besides, the authors of UW do not seem to take into account the malleability of risk and uncertainty. As shown by Douglas and Wildavsky (1982), uncertainty can be used to oppose any kind of interpretation of the world, and following Douglas (1992: 15), risk can be used as a generalised weapon of defence in an industrialised and globalised world where small communities are substituted by complex systems of interlinked and overlapping social networks. The language of risk, thanks to its abstract, generalising and 'objective' nature becomes the perfect instrument for such a protection. In other words, the concept of uncertainty is useful because it can free people from interpretations of reality that are imposed on them while the language of risk can provide an alternative.

There is a common point between Wynne and Douglas, as they share the idea that people turn to the organisations they trust. But while for Wynne trust is the end point of a decision making process that starts from the awareness of the public about uncertainty, for Douglas trust is the beginning. People's perception and definitions of risk and uncertainties depend on given interests that are associated with a specific lifestyle. These interests depend on the position that people occupy within the social structure, and every opportunity to exercise or evade social control will be exploited to pursue them. The importance of focusing on both exercising and evading control was stressed. In Wynne, uncertainty tend to be associated exclusively with forms of evasion of social control, while in Douglas categorising something as uncertain or risky can quickly become a way for the centre of society to maintain the status quo, or even increase its power base. This is exactly what the analyses of PROSAMO, aimed at exploring the contribution of dominant institutions to the overall debate, made apparent.

The analyses treated PROSAMO, and GMOs themselves, as cultural objects – that is, as a set of shared meaning embodied in form (Griswold, 1987). In general terms, it has been argued that PROSAMO and the institutionalisation of GMOs emerged as coalitions of different needs.

When it was initially conceived, in 1986-87, PROSAMO could potentially meet the different needs of the social actors involved. For the departments representing the government, it was a way to stimulate industrial investments in research in the new and commercially promising field without actually getting too involved financially. This of course meant giving an advantage to large companies who had the financial capabilities to invest in a risky business. It also represented the opportunity to create a homogeneous regulatory environment at the European level, where some governments were showing scepticism about the safety of GMOs. PROSAMO could create consensus in an arena where the policy of the Strong State (see Chapter 5) could not be employed. Within the national borders, the government was not very concerned with creating consensus towards science and economic policies. Indeed, this thesis has shown that there were some government officials who were concerned about the public response towards the release of GMOs into the environment, but that these concerns did no meet much attention from the ministry of agriculture for example (Chapter 1). Interest on the GM issue started to become evident only subsequently, especially within the department of Environment, but this happened really towards the end of the Thatcher era, when many other changes were occurring.

Industrial members of PROSAMO shared with the government similar concerns about regulation, with some more problematic aspects however (Chapter 4). PROSAMO clearly had a regulatory purpose in the sense that it was conceived to affect the regulation of the release of GMOs into the environment, regulation that everyone was expecting sooner or later. But some companies were looking for a particular regulatory trajectory, one that could at the same time: (i) reassure the public that GMOs were being dealt with with proper care (Levidow, 1994; Tait and Levidow, 1992; Tait, 2001) (particularly those companies like Unilever, whose economic activity was mainly of the business to consumer kind) – especially in light of the protests that were getting visibility in the US for the release of ICE-minus bacteria; (ii) slow down the pace of development of a technology that was seen as a potential destabilisation of the structure of power; (iii) raise the regulatory barriers especially in saturated markets (both food and chemical ones). Interestingly then, an initiative like PROSAMO was able to meet all these different, even opposing concerns and objectives.

From the PROSAMO archive, it appeared clear that the companies involved were generally favourable to a case-by-case, step-by-step kind of regulation as proposed by OECD (1986) and ECRAB (1986). The basis of this approach was the precautionary principle (PP), which focuses on the pervasive character of uncertainty. With PROSAMO, the companies involved wanted to justify their support for a restrictive regulatory regime based on the PP. Of course, they did not want this regulatory scheme to last too long, just long enough to find synergies between the new technology and the traditional business. This case-by-case system of controls managed by experts had to be progressively relaxed as information became available. From this point of view, it is possible to see the double objective of PROSAMO. As a scientific process, it could justify the companies' favour and support for restrictive regulation based on the PP. As a finished product, it could be used as an authoritative piece of science to justify the abandonment of the PP, the relaxation of controls and the constitution of a simplified risk-assessment procedure.

Within this context, for academic scientists to adapt to the rhetoric of uncertainty implicit in PROSAMO – despite the widespread belief that GMOs did not represent a problem for the environment – meant obtaining funds and financial resources in a historical moment when the government was interested in cutting public expenses, including the ones for academic research. Actually, this work argued that the scientists working on genetic engineering almost behaved as an epistemic community, which Radaelli (1999) defines, citing Hass (1992:3) "a network of professionals with recognised expertise and competence in a particular domain and an authoritative claim to policy-relevant knowledge". As an epistemic community, scientists emphasised certain aspects of the GM issue in order to help the other policy-actors to identify their own interests in an area characterised by numerous uncertainties (Chapters 4 and 6).

The involvement of scientists in the debate then, does not only confirm the flexible and instrumental character of uncertainty, but it also reveals that its legitimate use is bound to the social prestige of science and of its professionals. It was then possible to link the centrality of the authority of science with the use of the ‘genetic engineering’ formula as the dominant expression to refer to recombinant DNA technology during the 1980s and early 1990s.

The study of PROSAMO thus clearly contradicts what stated in UW. Public resistance towards science and technology cannot have been fuelled by an overconfident institutional body language which neglects uncertainty, because the rhetoric of dominant institutions was actually based on uncertainty. In the description offered in this thesis, uncertainty clearly emerged a malleable concept that was instrumentally used, within a precise plan, to achieve very different objectives. In line with Douglas’ interpretation, uncertainty was employed to oppose an interpretation of the world that was very common at the time (that GMOs were safe) and the language of risk was meant to offer a new (in this case to lead towards the confirmation of an existing) interpretation. In other words, it was possible to see how risk and uncertainty came to assume the character of collective definitions of the public good because they could lead to the fulfilment of different wants and desires.

A detailed study of PROSAMO then, gave the opportunity to investigate empirically what the attitudes of the dominant institutions towards GMOs were and how they behaved between the mid ‘80s and the early ‘90s. In this way, the concepts of risk and uncertainty, which have been used fairly unsystematically in the previous accounts, have been made more intelligible.

## *9.3 Contested Rationality: Levidow’s account of the GM regulatory debate*

Despite my interest in the institutional dynamics being fairly unusual compared to mainstream approaches, it is not an isolated case. Noticeable exceptions are also Jasanoff (2005), Levidow (1994) and Tait (2001). They all share an interest in what dominant institutions did in order to deal with the GM issues and how their actions contributed towards the institutionalisation of GMOs. Jasanoff is a bit too general to be of great interest for this thesis. More relevant here is Levidow’s account of the early stages of the regulatory debate over GMOs.

As seen in Chapter 2, Levidow borrows Schwarz and Thompson's (1990) adaptation of Douglas' grid/group model to make sense of the institutional dynamics. He argues that the GM regulatory debate has been characterised by a conflict between different cognitive frameworks that had different ideas about nature (molecular biologists vs ecologists). ACRE, in this account, emerged as a way to mediate between different rationalities within the regulatory context. Chapter 2 illustrated some of the limits of Levidow's study. Quite rightly, Levidow describes the framing of GMOs by different social actors as the result of analogical associations with different ranges of previous knowledge. The problem is in the way these analogical associations are treated. Indeed, Levidow claims that Industry tried to frame biotechnology with reference to previous forms of innocuous or at least acceptable practices like beer brewing or plant breeding and that this analogy served industrial commercial interests especially at the market stage. He then contrasts industrialists' knowledge claims with environmentalists ones, who seek the support of ecologists who compare GMOs to novel organisms. In this way, Levidow is able to show that knowledge claims are distorted, or at least biased, by industrial interests. The final result is an implicit prescription to government and regulators to make their value-judgements explicit, and an explicit call for biotechnology critics "to resist the regulatory strategies for marginalising their accounts of the risk problem" (p. 218). This is a very problematic approach to adopt because it treats one set of knowledge claims as illegitimately ideological, while the other as a legitimate expression of concerns, when it should in fact be treated as ideological as well (see Chapter 2).

This asymmetric treatment is nowhere justified and is actually supported by the individualism dominating Levidow's account, so that in the end we do not have a completely satisfactory sociological explanation of the events. Only once we consider policy actors as a coalition of agents brought together by shared interests we are in the position to really understand policy action, its limits and it potential.

True, Levidow's work is influenced by Schwarz and Thompson's approach, which is sceptical about the use of interests as an explanatory device. As well summarised by Leonard (1992):

> Schwarz and Thompson claim that the dominant assumption of most theoretical models of public decision making is the pursuit of interest. They regard this approach as totally unsatisfactory: it fails to concern itself with the origins of interest or goal setting, it ignores the need for people to justify their actions morally, it overlooks the organizational context of rationality, and it treats social institutions as clusters of individuals rather than cultural entities.
> (p. 390)

However, my account of PROSAMO and the institutional dynamics characterising the early regulatory debate on releases of GMOs into the environment made clear that I do not consider institutions as clusters of individuals, but as a set of practices that emerge and are sustained as collective definitions of the public good. Thus, 'genetic engineering' as a special kind was sustained because people using it could achieve their different objectives. The precautionary principle (PP) was also a shared interest, as seen in Chapter 4. PROSAMO needs to be understood in the same way, as shared interest embodied in form. It is obvious that the definition of genetic engineering and genetically engineered organisms (later called GMOs), the PP and PROSAMO as public goods is not independent from the surrounding circumstances. As the context of operation of the social agents changed, what rose among some of the institutional actors was a shared interest in the discontinuation of the operation of established institutional arrangements. GMOs and the PP became an enemy to be contrasted in political arenas and PROSAMO ended up serving new and different purposes. Proper consideration of interests is then essential to achieve a proper understanding of joint action and institutionalised activities.

But after having examined PROSAMO in detail, another limit in Levidow's position could be identified. In his work, cognitive frameworks are clearly a reflection of "myths of nature" (Schwarz and Thompson, 1990) that are incompatible with each other and that invariably affects individuals' judgements and determine their responses. Levidow thus argues that technology development is not neutral but politically oriented and imbued with certain cultural values. Following Schwarz and Thompson (1990) these values are mapped according to Douglas' typology (see Chapter 2) – as if this typology represented distinct political cultures. Levidow's call to resist any attempt of marginalisation of alternative accounts of risk problems also echoes Schwarz and Thompson's conclusions, when they claim that "our institutional procedures cannot be captured by just one cultural bias" (p. 147).

This thesis argues against such a static interpretation of Douglas' framework and presents evidence for a more dynamic approach. The discussion on the authority of science clearly brought to light what people actually do in order to maintain power and achieve certain objectives. For the scientists involved, for example, authority and prestige was sought through a constant shifting of identities. In other words, the social types identified by Douglas – individualists, hierarchists, egalitarians and fatalists – look more like rhetoric tools to be use strategically for the presentation and preservation of self rather than monolithic entities. It is interesting, for example, to notice how industrial scientists used the different kinds of identities to describe themselves. Sometimes they are mechanisms of a larger machine towards the functioning of which they contribute ("you know, we were there to protect the interests of the companies who were paying our salaries" – Chapter 5, p. 124). On other occasions, they complain because they are not trusted anymore and they can hardly make a difference without asking help from other departments in the companies (fatalistic attitude – Chapter 8). More frequently, they have an image of themselves as being part of a wider scientific community (egalitarianism), a situation for example stressed when dealing with the same PR departments that were supposed to help them communicate to the public or when describing their role in the policy process.

Academic scientists too have an interesting tendency to frame themselves differently when they talk about different things. Generally, they tend to use more frequently both an individualistic and a fatalistic rhetoric. In A1's words one can easily see different images employed at the same time. Academics scientists' work is more independent and objective than industrial lab research, but at the same time they are controlled by the sponsors, constrained by the bureaucracy or not listened to by the rest of society (Chapter 5). It is clear from the interviews that those political cultures identified by Schwarz and Thompson and borrowed by Levidow do not necessarily exclude each other. Another interesting example is academic scientists who, on the one hand, complain because scientists are not listened to anymore (fatalism), but at the same time find vindication in the recognition they receive from their peers (egalitarianism). A1 description of the reception of the PROSAMO results in academic journals shows how being fatalistic in one set of relationships does not preclude a very active sort of political life in others. In the case of PROSAMO it actually seems that as scientists were feeling they were losing control and social standing they were able to turn inwards, within the boundaries of the scientific community, or even of their specialty, to compensate. Fatalism and egalitarianism are not mutually exclusive, and given that this combination is not exclusive, it is hard to see why the others should be. There may certainly be dominant tendencies, of course. For example Thatcher policies may have injured scientists' prestige and pushed them to adopt a fatalistic attitude. But even in this case, Chapter 5 and 8 actually reported scientists' response to be interestingly varied, for example with visible attempts to get closer to the logic of the market and to act as business partners or competitors of more traditional companies.

The scientists' working for the government appeared a bit more rigid than the academic and industrial scientists. Both Coleman's (1989) contribution and the DTI interviewee were discussing the need to keep academic scientists under control. Implicitly, they were referring to a typically hierarchical frame of mind. Nevertheless, in talking about and dealing with European regulators, government officials were employing an individualist strategy rather than a hierarchical one, using science and "quantification as a method of stating problems" (Douglas and Wildavsky, 1982, p. 97) and as an instrument to find an agreement in a sort of exchange.

In other words, the social types identified by Douglas and used by Schwarz and Thompson do not reflect a particular identity held by social actors, but they look more like flexible instruments that provide multiple faces when different sets of relevant social relationships are invoked. After all, in the context of contemporary western society where people belong to multiple, interacting and overlapping social networks the contrary would be surprising. In different situations with different needs one can rely on the identity that is more likely to guarantee a degree of influence or protection.

This more dynamic framework helps to make sense of the other difference between Levidow's account and mine. While in Levidow ecologists are invariably sceptical about GMOs, the study of PROSAMO revealed that GMOs were perceived to be safe even by a large majority of the ecological community. I do not want to claim that Levidow is mistaken, quite the contrary. I simply want to emphasise that this difference raises an important question: why did the difference between cognitive frameworks start to become significant in the timeframe considered by Levidow, while they were not earlier? The interpretation of Douglas' model applied here provides a way to tackle this question, even though this was not its explicit purpose. The approach adopted in this thesis considers identities and beliefs within the context of the structure of social relationships. If this structure changes, and it has been shown that it did, these beliefs and identities are likely to change as well. Of course, there need to be some coherence between past and present positions, in the sense that not all changes are legitimate. But for the ecological community this was not a problem. It was easy for ecological considerations to find fertile ground as tests and experiments like the PROSAMO ones, which were sponsored by industry, were justified by ecological concerns. In other words, it was not difficult for the ecological cognitive framework to be coherent with past considerations.

Having established why the polarisation between molecular biologists and ecologists could occur, it is necessary to identify the actual reasons for it happening. The question that needs an answer is: what are the social factors that stimulated this polarisation of beliefs and identities?

### 9.3.1 ACRE and the move to statute based regulation

Chapter 7 demonstrated that the coalition of interests behind PROSAMO was not a monolithic alliance, and that it actually underwent significant changes. As PROSAMO went on, the structure of social relationships sustaining it progressively changed thus changing the meaning of PROSAMO itself. Chapter 1 offered a glimpse of these changes when discussing the semantic changes in labelling rDNA containing organisms taking place at the beginning of the 1990s, when the “genetic modification” formula slowly began to replace the “genetic engineering” one. These terminological changes, it has been argued, reflected wider changes at the level of social relationships that also involved the position of professional experts in society.

Chapter 7 showed that relationships among the participants of the debate, as well as among the members of PROSAMO, began to be problematic when ACRE became a statutory committee, following the approval of European Directive 90/220. When only a voluntary system of controls was in place, the advisory committee supervising the releases of GMOs was perceived as a networking and advice centre. In other words, it was the institutional arena where the epistemic community could exercise its power in the policy process. With ACRE becoming a statutory committee, GMOs started to be perceived by many of the scientists involved as a bureaucratic issue. It should be remembered that with the establishment of ACRE and through GMOs, the Department of Environment was seeking to rectify a fairly negative reputation of incompetence. The DoE initially set up its own advisory committee on releases into the environment, whose competences overlapped with the committee established by the HSE. ACRE is the result of the merging of these two committees, merge that implied a negotiation between different political priorities. In the new context, ACRE’s members were implicitly instructed that they could not help the applicants anymore in their application process. This move from a voluntary system of controls to a statutory one really represents a move from an epistemic community approach to policy-making to a logic of bureaucratic politics, in which the literal interpretation of rules became a solution to political disagreement. As rule following became a political requirement, GMOs became a bureaucratic issue and scientists turned into bureaucrats. With scientific expertise devoid of its role of consensus building, scientists could not do much other than rely on their disciplinary affiliations. Disciplinary differences thus became part of a political struggle that involved environmental groups (and the DoE) against some big multinational corporations. Different cognitive frameworks polarised to serve opposing poltical interests. Within these changes, as seen in chapter 7, the role of scientific expertise in the definition of GMOs decreases and bureaucratic and biological data ended up coincing. From this point of view, the way 'genetic modification' and GMO institutionalised gave rise to new practices and behaviours that turned around GMO as a controversial but nevertheless stable category.

This description of the events gives the opportunity to offer a more dynamic interpretation of PROSAMO than the one provided by Levidow. He interprets PROSAMO as a series of experiments that were aimed at relaxing controls. Different rationalities however prevented this from happening. In his own words, "experimental results sharpened methodological conflict about how to define and investigate relevant uncertainties" (p. 177):

> As Krimsky (1991:151) notes, geneticists and ecologists embed facts in a different model of causality, so new facts do not necessarily bridge the disciplinary divide. Indeed, new knowledge opened up more areas of scientific uncertainty for risk-assessment research, such as microbial gene transfer. (p. 177)

From the previous chapters, however, it is apparent that the differences between disciplines became significant only after political pressures and conflict deprived experts of their central role. They actually show that when ACRE became statutory, science stopped being considered that relevant. Describing the European Community as political, the widespread belief that scientists were not trusted anymore and all the effort put into improving public communication should raise doubts about PROSAMO as simply a way to relax controls. This was the aim when PROSAMO was initially conceived and set up, but studying it diachronically as a cultural object made apparent that its meaning changed significantly over time. There was actually a widespread awareness of the limits of scientific expertise very early on through PROSAMO. As seen in Chapter 8, with time PROSAMO turned from being an exercise of the authority of science into being an attempt to restore its credibility. From this point of view, ACRE does not look like an instrument to mediate between different rationalities, as Levidow claims. In fact, it is likely to have polarised them.

This role of the DoE in the institutional dynamics and the development of the GM controversy is something that is often underestimated in the current accounts, including Levidow's. As seen in Chapter 2, and stressed again in the previous sections, Levidow does not really treat the two sides of the GM controversy, industry and environmental movements, in the same way. Knowledge claims by industry is treated as biased by interests while those of environmental groups are treated as legitimate expressions of concern. By refusing to be asymmetrical and by giving up an individualistic approach this thesis was able to expose this unbalanced treatment. It is now possible to legitimately see these accounts of the controversy as part of the controversy itself and they are used to promote a particular cause within it. This work has also been able to add another dimension to the explanation of the evolution from 'genetic engineering' to 'genetic modification'. 'Modification' was probably not just a way to make GM products more acceptable, but it may also have reflected a set of social relationships where experts were not decisive players anymore in the definition of reality.

### *9.4 On values and principles: NIMBY vs NIABY*

There is one last element that the history and the method adopted here have helped to uncover. As seen, Levidow argues that technological developments and values are closely interlinked and a static 'cultural theory' framework is used to explain the connection between technology, values and the political arena. As put by Levidow, "[D]espite obtaining additional scientific knowledge, the regulatory system faced implicit ethical judgements on the acceptability of undesirable effects" (p. 178). It is reasonable to assume that values are important factors in political decision making, but there is no reason to consider them any less flexible than identities or beliefs, as they are social constructs too.

The very fact that ecologists 'changed their mind' about the safety of releasing GMOs into the environment proves that as identities and beliefs, values are also used strategically and establish a dynamic relationship with the surrounding environment.

The claims that people make to justify their actions morally need not to be written in stone. The sense of immobility may be due to the fact that there are constraints in the way we use symbolic and cultural resources as there are when we use material ones. A perspective similar to the one developed by the *Resource Mobilization Theory* (RMT) (Zald and McCarthy, 1987) for material resources can be used for symbolic and cultural elements too, which are also scarce resources. Let us consider, for example, the debate on pasta produced through irradiated wheat discussed in the introduction. Before the story about "irradiated" pasta circulated in the Italian newspapers, environmental groups talked about nature as an active agent providing human beings all they needed. For this reason, humans should not interfere with nature. This view contrasted with the one held by some scientists and industrialists, who considered the manipulation of nature as appropriate if this could benefit humans themselves. It would have been easier for organic farmers and environmentalists to describe and justify their relationship with the natural world in terms of good and bad agency, rather than denying it completely, but acknowledging that human agency could be a good thing would have represented a partial legitimisation of those groups who considered interference with natural processes acceptable. It was interesting to see how the basic moral framework employed by the organic farmers association and by the Greens changed once the story about the "irradiated pasta" became public. Human action was then justified if it accelerated the natural process of evolution that would have happened anyway in a few thousand years because of cosmic radiation. This example illustrates that values can appear fixed and to have inherent characteristics, but they can actually change or canbe used to justify very different behaviours. There is nothing inherent in them, and their meaning depends on the way groups and individuals using them interact. The case of the ecologists actually shows that groups and individuals may present values as fixed as part of their artful presentation of a given issue.

Closer to the mark in terms of explaining what was going on at the institutional level of the GM debate is Tait (1988, 2001). As Chapter 7 (Section 7.4.1) explained, she introduces the distinction between value-based and interest-based responses to controversial issues, and she claims that the introduction of the PP made value-based responses to technology so prominent that it undermined the role of evidence in decision making about risk. Although placing the authority of science at the centre of a sociological explanation of the GM debate, it has been argued that Tait's approach offers a misleading interpretation of the PP.

As in the case of GMOs, or PROSAMO, or identities and beliefs, also rules and principles are flexible entities that are used by social agents as guidance for their behaviour. Their utility and meaningfulness change as the structure of social relationships, and the interests associated with people's position within it, change. Garfinkel (1967) was actually very clear in showing that rules can be easily interpreted and manipulated for all practical purposes. Why should the precautionary principle be any different?

Regulation then, and particularly the PP, cannot by itself have favoured the introduction of ethical concerns into the debate, as argued by Tait. The PP should not be blamed for weakening the role of scientific evidence in decision making, because it is not the explanation of the events, but part of what needs to be explained. If ethical concerns entered the debate, this is because powerful social agents – like green movements – were able to mobilise the resources they needed to make a given interpretation of the PP the dominant one. The explicitly ideological nature of the public debate over GMOs needs thus to be conceived as a by-product of the institutional dynamics described in this thesis – dynamics that made the role of scientists as recognised professional experts superfluous to the definition of issue at stake as the debate moved from an epistemic community approach to a logic of bureaucratic politics.

## 9.5 The Changing Role of Professional Expertise

The bureaucratization of GMOs actually triggered a series of events that have further decreased the role of science in the debate. As stated in Chapter 8, the changes in the regulatory structure had important implications, as they made scientists' exclusive power of providing credible infomation irrelevant. A close look at the PROSAMO experience and the Unilever archive shows that scientists involved in GM work, independently of their institutional background, generally started to think that science, and therefore themselves, lost prestige in the wider social context. Reading the written evidence provided to the House of Lord Science and Technology Committee by various organisations between 1992 and 1993 gave an idea of what the feelings among scientists were. Influenced by this perception, both private and public scientists undertook a process of redefinition of their communicative strategies. When PROSAMO was conceived, it represented a way to formalise the scientific consensus that was already present and to establish high standards for criticising the new technology. This strategy could work only because science was, or was perceived to be, credible. Once this confidence in the credibility of science was lost by the social actors using it, the communicative style became apologetic and this gave even easier access to ethical considerations. Feeding the hungry world as a moral justification for the new technology allowed people who did not agree with that vision to say something about it without having to be scientists. In other words, grounding communication along moral lines may have made criticism much easier because it did not require the high standards of evidence necessary to criticise scientific work.

## *9.6 New Opportunities*

The way PROSAMO has been analysed in this thesis has not only helped to highlight important characteristics of regulation and governance processes, but it also opened up new opportunities for research.

For example, the experience with the regulatory debate on the release of GMOs will serve as a very useful comparator in the analysis and interpretation of other national contexts within Europe – an analysis that can benefit from the approach adopted here (identification of shared interests). A comparative study is the necessary basis for understanding the cultural diversity within Europe and for grasping how this diversity contributes to and/or is taken into account in the building of the European Union as a unified political entity.

The identification of shared interests can also be useful to expand the present work further. In this thesis I have taken for granted what has been said by my interviewees without exception: that GMOs were generally perceived as safe by a large majority of the scientific community. However, I could have problematised these claims to see how GMOs did end up being considered safe. Following Barnes (1977:103), and as emphasised already many times so far, a concept is generally accepted and applied because it has been judged to be instrumental to the achievement of different goals and objectives. Some questions can thus be asked, and the answers will be very interesting indeed. Given the controversial history of recombinant DNA technology, how and when did the definition of GMOs as safe become the accepted definition? For what different reasons did scientists belonging to different disciplines agreed in the safety of GMOs? How is the perceived safe nature of GMOs associated with the position these disciplinary groups occupied within the social structure? How did socio-political changes affect the general acceptance of GMOs as safe entities? These questions could be the basis for a new research project. In doing this work I had a glimpse of what the answers to these questions could be. It was interesting for example to learn that plant breeders were considering GMOs safe because they were comparing them to traditionally bred plant varieties. More interestingly, they were not simply comparing them in genetic terms, but in terms of practices associated with the selection process. In Lupton (1987:550), for example, it is clearly stated that the introduction of GMOs would have had to undergo the same meticulous selection process of traditionally bred plants.

> Even when a method of transformation has been developed for wheat, it is unlikely that genetic engineering will greatly speed up the development of new varieties. A new breeding line, or an established variety transformed to become resistant to an important pathogen, will have to undergo all of the tests applied to a conventionally-bred variety before it can be released to farmers.

Plant breeders' expertise and position within the agricultural sector was therefore not jeopardised by genetic engineering. GMOs were safe because genetic engineering did not seem to pose a threat to a given social structure. If anything, it seemed to expand the influence of plant breeders[71].

Ecologists may have reached the same conclusion (GMOs are safe) through a different route. I would like to report a short quote from a social scientist I interviewed for this project, who was a particularly active observer in those years. We were discussing the position of ecologists within the debate. The anonymity of the quote follows an explicit request. We were talking about Crawley, one of the main scientists, an ecologist, involved in PROSAMO:

> I remember, I didn't meet him but the researcher who was doing this project with me did meet him, and got the impression that he was very strongly in favour of GM crops. And it had something to do with oak trees. I don't remember the details but I think he's very keen on GM trees for some reason.
>
> […]
>
> I mean, there are different kinds of ecologists around. Until I worked for Scottish Natural Heritage, which is full of ecologists […] I thought that ecologists were really multidisciplinary holistic kind of researchers. But when I was there I met people who were totally obsessed by one species. So they had their fish, their bird. Everything they did had to be geared toward the protection of that species. So there's that kind of ecologist too. And I think that for that kind of ecologist who wasn't interested in the overall more holistic environment, then anything that was going to save their species would be good.

Besides making Levidow's contrasts between microbiologists and ecologists even more intriguing, this quote further emphasises the importance of considering shared interests for an understanding of how GMOs ended up being unanimously perceived as safe by a highly diverse scientific community.

[71] See also Barton and Brill (1983), Day (1985a), Fowler (1985), Brill (1986), Hansen, Bush et al. (1986), Gould (1988), Flavell (1989).

### *9.7 For Policymakers*

I would like to conclude this work with some considerations that may be relevant for the current debate. Margaret Thatcher once said that there is not such thing as society. Her government policies reflected this statement in the creation of an institutional confusion that really represented a cultural transformation from the way society was experienced before she came into power. Thatcher's governments' preference towards market solutions and the private sector, particularly the big business, had knocked on effects on the overall experience of social reality.

The changes of the Thatcher's era stimulated a wide range of responses within the scientific community. As seen in earlier parts of this work, in the context of agricultural biotechnology some of the most active sciertists in the field tried to come up with new strategies aimed at the preservation of their prestige and credibility. Among these, an unusual and well publicised alliance between big industries and some members of the scientific community was identified. These strategies fed back into this general context of institutional confusion. From this point of view, it is tempting to establish a parallel between the changes in the natural order represented by GMOs and the changes inthe institutional order people experienced during and soon after Thatcher's years. If we were to follow a Durkheimian interpretation, GMOs became thesymbolic representation of and the sacrificial victim for this cultural transition. If this is really the case, PROSAMO had very little chances of succeeding in making GMOs more acceptable. Of course, as emphasised many times already, these chances would have improved if the GM controversy had been managed in the more symmetrical fashion described earlier.

Instead, the approaches that have so far tried to explain and to deal with the GM controversy have always been unduly asymmetrical. As shown in Chapter 2, the deficit model – which states that more knowledge about a controversial issue tends to reduce opposition towards that issue – tends to over-represent the interests of the scientific community and of dominant institutions that rely on it. Chapter 8 also argued that it is not just the information that is given and received that matters, but also who says what and how. From this point of view, the attempts of communicating biotechnology in the early 1990s may not have helped much, as they may have relied too much on communication techniques well established within the companies but not very credible. The alternative approach however – the ethnographic one – is not very helpful either. I wholly agree with what Tait (2001c) has claimed – that the "emphasis on the knowledge claims of different lay and expert groups provides little guidance beyond a generic message (still untested) about the need of pluralism and wider public involvement in decision making" (p. 187). The ethnographic approach is well suited when exploring the relationships between experts and non experts in local contexts, but cannot be easily adopted when there are large, highly differentiated environments under the microscope. In these larger and differentiated contexts, scientific information from a credible source still seems to be able to make a difference. This is what Sturgis *et al* (2005) have identified in their surveys on biotechnology (*Attitudes to Genomics*, 2002-2005). They argue that "the empirical evidence does not support so strong a rejection of scientific knowledge as a factor which serves to, at least partially, shape and mould the distribution of opinion toward science" (p. 48). Shepherd (2005) is in the same line, showing that people's attitudes towards genomics are not that negative after all. The ethnographic approach instead, tends to undervalue the role of professional expertise – an attitude that is more likely to stimulate harsh responses from experts and to fuel the divide between natural sciences and social studies of science.

Despite their differences then, both these approaches – with the latter becoming somewhat dominant in recent years – shared a tendency to treat the GM issue in an asymmetrical way. In doing so, they both ended up alienating relevant groups from the decision making process, thus fuelling the controversy even further, rather than solving it. Politically speaking, refusing to be asymmetrical and treating all sides of the GM controversy in the same way would have facilitated the identification of existing or potential shared interests. By promoting them, the individuals involved would have been more likely to cooperate to establish or seek to defend any shared interest as a public good, and this would have possibly compensated for the overall institutional chaos brought about by Thatcher's approach to policymaking.

There is still hope for agricultural biotechnology, however. The current economic crisis has strongly deligitimised the role of the private sector, so cherished during the Thatcher years, as the drive of socio-economic development. The State, instead, has started to reposition itself as the guarantor of social welfare and of the public interest, although, it must be said, with little success so far. Nevertheless, it would be wise to exploit this newly acquired role of the State to start a process of reconciliation on the GM issue. A process of reconciliation will require a serious commitment to the identification, and possibly the purposeful shaping, of shared interests among relevant stakeholders as well as the promotion of these through the enactment of the appropriate reparatory rituals through which GMOs could symbolise this new role of the State in establishing and defending the public good.

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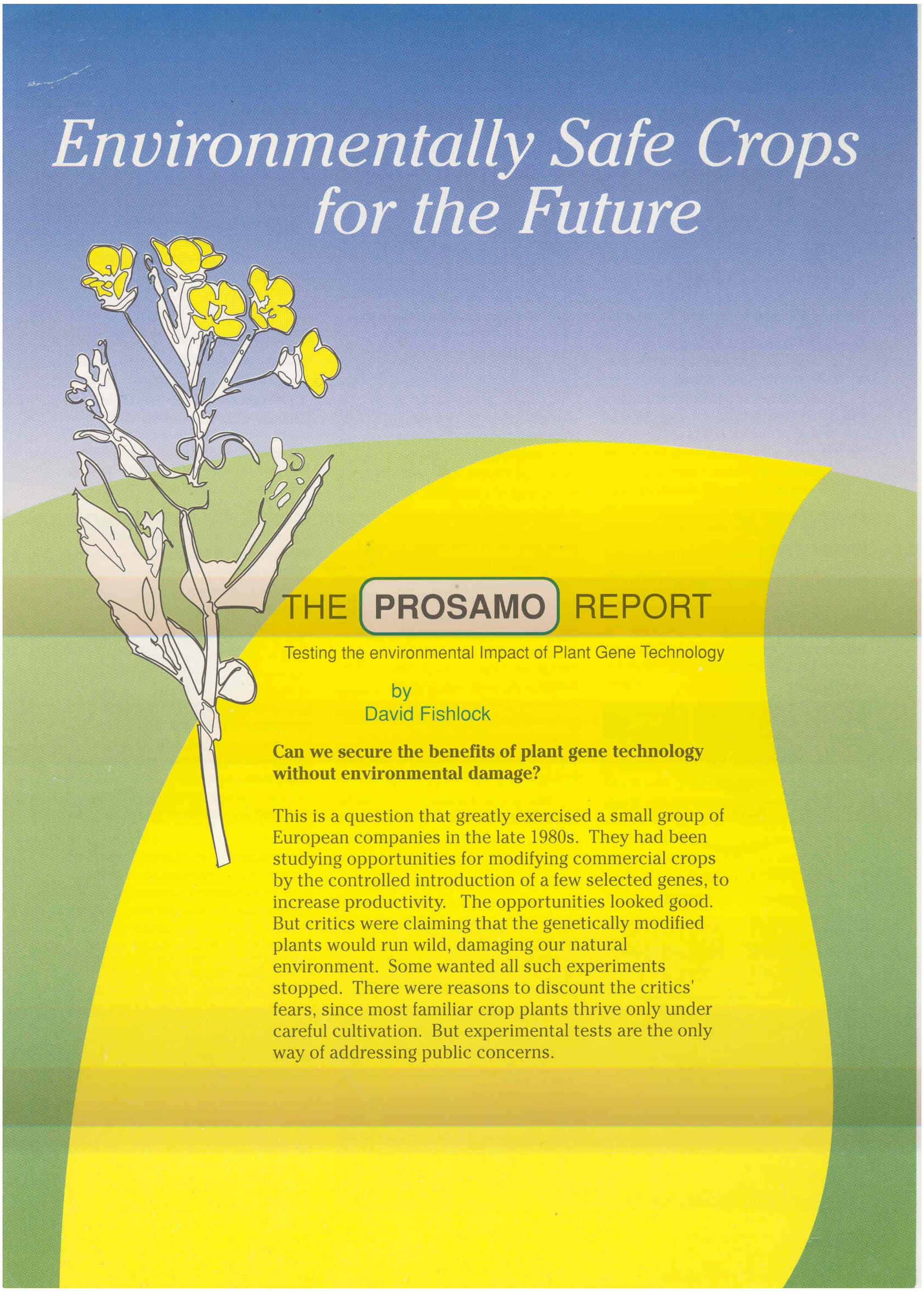
# Annex I



*Environmentally Safe Crops for the Future*

THE **PROSAMO** REPORT

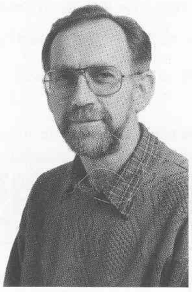
Testing the environmental Impact of Plant Gene Technology

by
David Fishlock

**Can we secure the benefits of plant gene technology without environmental damage?**

This is a question that greatly exercised a small group of European companies in the late 1980s. They had been studying opportunities for modifying commercial crops by the controlled introduction of a few selected genes, to increase productivity. The opportunities looked good. But critics were claiming that the genetically modified plants would run wild, damaging our natural environment. Some wanted all such experiments stopped. There were reasons to discount the critics' fears, since most familiar crop plants thrive only under careful cultivation. But experimental tests are the only way of addressing public concerns.

# Annex II



*Dr Phillip Dale,*
*John Innes Centre,Cambridge*

*Dr Michael Crawley*
*Imperial College, Ascot.*

With oil seed rape, Dale was again interested in "gene flow" and the incidence of cross pollination with unmodified lines of species growing nearby. Here he used seeds supplied by Plant Genetic Systems with resistance to herbicide.

At the centre of a hectare (100m x 100m) plot he planted a 9m diameter patch of altered rape, with a "bulls-eye" 1m across of unaltered rape. Surrounding these circles was unaltered rape. The idea of the bulls-eye was to ensure a patch that was saturated with genetically modified pollen.

Dale harvested seed from the entire hectare, raised seedlings under glass, sprayed them with herbicide and logged the number of seedlings showing resistance. All told, he screened over half-a-million plants. "It gave us accurate figures even for very rare events". He also confirmed evidence for gene transfer by molecular analysis of surviving seedlings.

"In the case of potato, we found no evidence of cross pollination between the crop and the two solanaceous weed species", Dale concludes. Gene flow proved to be extremely restricted, with a frequency of transfer falling sharply from 24 per cent, where leaves of modified and unmodified plants were touching, to zero at only 20 metres or beyond.

Comparable figures for oil seed rape show a similar sharp fall in hybridization from 5 per cent where leaves of altered and unaltered plants are touching, to only 3 in a million at 47m.

**Big though the PROSAMO programme was – nothing on this scale has been done in the US – it is not the last word, warns Crawley. "People should not simply extrapolate our results to other crops".**

**But Crawley applauds the British step-by-step approach to the controlled release of genetically modified organisms – "an excellent way to proceed".**

**In a nutshell, it is to start by controlling experiments very strictly – as was done in the case of the UK's first modified plant release by Phil Dale in 1987. Then, as the regulators gain confidence that experiments are yielding nothing untoward, and are behaving as predicted, those controls can be relaxed, step-by-step.**

**The Prosamo results add greatly to confidence that the new plant gene technology can help to feed a hungry world.**

Further Reading:

***Ecology of Transgenic Oilseed Rape in Natural Habitats,***
*by M J Crawley, R S Hails, M Rees, D Kohn and J Buxton*
*Nature 363 620 - 623 (1993)*

***Gene Dispersal from Transgenic Plants by Pollen,***
*by P J Dale, H C McPartlan, R Parkinson, G R MacKay and J A Scheffler in "The Biosafety Results of Field Tests of Genetically Modified Plants and Microorganisms (Eds R Caspar and J Landsmann) Braunschweig, Germany: Biologische Bundesanstalt für Land - Fortwirtschaft p73 – 78 (1992)*

More information can be obtained from:

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# Annex III

### ***PROSAMO's outcomes***

As mentioned, PROSAMO was set up to determine the environmental impact of GMOs. As stated by Crawley (1992), the PROSAMO researchers tried to provide an answer to 3 main categories of problems:

1. Problems concerned with the persistence of the vegetative plant and its propagules in different kinds of environment;
2. Problems relating to the spread of the plant by vegetative growth and by dispersal of seed, in both arable fields and natural habitats;
3. Problems involving the risks of lateral spread of engineered genes, either by pollination of different plant species, or by other means.

The crops of choice for the experiments were oilseed rape, potato, maize and sugar beet, the genetically modified seeds of which were provided by some of the company members of the PROSAMO consortium. These plants were selected for their convenience: being the modified varieties of these plants closest to the market stage, there was a higher number of seeds available for the experiments. The plants were tested in 12 different habitats equally distributed in 3 sites (South West, South East and Scotland)to account for environmental variability.

With regards to the first two problems above, the experiment consisted of a comparison of the performance of transgenic and non-transgenic lines within a squared plot measuring 25 metres * 25 metres. As explained by Crawley (1992:46),

> half of the area was fenced to exclude large vertebrate herbivores [...] and half was open to grazing [...] half of the area was cultivated to remove natural vegetation and to provide a competition-free seed-bed for germination. The other half of the plot consisted of undisturbed, dense perennial vegetation. Within the 4 sub plots the seeds were sawn into 25 cm x 25 cm quadrants [...] Onto these smaller quadrants, the

following treatments were applied in factorial combination: plus and minus mulloscicide, plus and minus insecticide, and plus and minus fungicide. At two habitats at each site, a small-mammal exclosure experiment was also carried out.

The researchers "measured germination, dormancy, seeding mortality, plant growth, herbivory levels, flowering, fruiting, seed production and seed mass for the different plant lines under a wide range of environmental conditions" (Crawley, 1992:43) as a way to determine the ecological fitness of transgenic varieties when compared to non-transgenic ones. Crawley et al (1993) provides specific figures for oilseed rape. He claims that oilseed rape's net reproductive rate λ for all three genetic lines used was mainly dependent on interspecific plant competition. In a competition-free environment like the cultivated plots there was λ>1 (where a rate greater than 1 means that a line will increase exponentially in abundance while a rate less than one will move towards extinction). More precisely, "maximum λ values for the three genetic lines were 19.1, 15.7 and 11.5 for the control, kanamycin- and glufosinate-tolerant lines in 1990" (Crawley, 1993:622). In environments where natural competitors were allowed to grow transgenic varieties showed a value of λ<1.

As to the other crop plants used, the experiments (Crawley, 1992:48-49) showed that

- "potato lines planted into natural habitats showed a general tendency for mean tuber size to decrease from year to year, and for vegetative plant numbers to decline with time (even though the numbers of tubers per surviving plant did increase, as tuber size declined). There was no significant effect attributable to the transgenic lines, except in so far as differences between the lines were associated with differences in initial tuber size (not surprisingly, this had a profound effect on subsequent plant performance)"
- "maize did not ripen seed in any habitat in 1991" and there was no difference between different lines in germination rates.
- "Seedling sugar beets show extremely low survival in perennial vegetation and amongst annual weeds".

As to the problem of cross-pollination (see Dale (1992) and Fishlock (1993)), the researchers planted 750 genetically modified potato tubers in a tennis court size plot, which was surrounded by eight similar plots cultivated by non-transgenic potatoes. They then planted among the potato plants two weed relatives of the crop before the potatoes began to flower. There was no evidence of cross-pollination between potatoes and weed and cross-pollination between transgenic and non-transgenic lines dropped from a frequency of 24% with the different lines touching each other to 0 at a distance of 20 metres.

A similar logic applied to the experiments with oil seed rape. The researchers planted altered and unaltered oilseed rape seeds within a 1 hectare plot. The altered plants were placed at the centre of the plot, within a 9 metre diameter patch. The researchers then harvested the seeds from the entire plot, and determined that the level of hybridization between modified and non modified lines fell from 5% where leaves of different lines were touching to 3 per million at 47 metres.

From the experiments, the researchers concluded that the genetically modified plants that were tested were unlikely to represent a threat, although it was acknowledged that different species or crop plants expressing different traits may provide a competitive advantage in certain natural environments and therefore posing a risk of becoming invasive (Crawley, 1992: 49-50).